VOLUME 12 #2 DECEMBER 1996 PRICE $6

EXPERIMENTAL MUSICAL INSTRUMENTS

For the Design, Construction, and Enjoyment of Unusual Sound Sources

Above: Aidófonos, or bamboo clarinets, by Ángel Sampedro del Río. See the article starting on page 7.

THE LONGEST STRINGS

Along the shore of the North Sea, where mountains rise steeply from the fjords, there are few roads. To carry heavy objects to farmhouses perched here and there, residents have developed a system of transport wires, extending great distances up the mountainsides. These wires, it happens, possess remarkable sonic properties, and they are full of possibilities for sound art. In his article in this issue of *Experimental Musical Instruments*, Atle Pakutsch Gunderson checks in from Norway to describe the playing of the wires.

Also in this issue you'll find the second half of Ray Brunelle's history of sound effects in radio, film and theater. There is a report on the recreation of a medieval zither based on an illustration in an illuminated manuscript. Beautiful saxophones and clarinets of bamboo are here, as well as homemade instruments designed for just intonation, wild and improbable sounds from creatively mis-wired electronic keyboards, and much more.

So open, and read.

I ENJOYED Mitchell Clark's article "Some Basics on Shell Trumpets and Some Very Basics on How to Make Them" [*EMI* Volume 12 #1, Sept. 1996]. The discography would be more complete by adding Colin Offord's bass conch blowing track on his Great Bowing Company's *Noman*, Mountain Music MM #001. Great bass conch blowing and Great Island Mouth Bow playing.

Dr. Guy Grant

JUST THOUGHT SOME might be interested in a new show at the Metropolitan Museum of Art in NYC called "Enduring Rhythms: African Musical Instruments and the Americas" — everything from tap dance shoes to large log slit drums! It will also include a West African kora and a Gravikord, my instrument featured in *EMI* way back in April 1988. It will have over 80 instruments and will be organized — "displaying African instruments alongside their American adaptations (to reveal) a 400-year transformation of instrument construction, use and musical style. The exhibition traces the impact of African musical culture on the Americas. In so doing, it places in perspective the process by which different cultures inform and influence each other in sparking the creation of new forms and structures while maintaining close ties to tradition." — quote from press release.

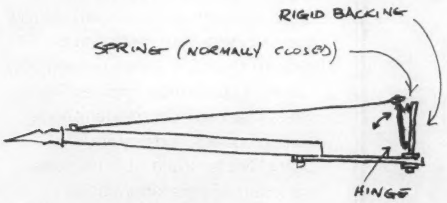
It will be on from October 3rd through March 31st at the Met, Arts of Africa, Oceania and the Americas; 1st floor; The Michael C. Rockefeller Wing. There will be a free recorded tour offered featuring recordings of selected instruments on display (including a bit of "Piccadilly" on the Gravikord and the tape will be framed by "Jungle Walk" from my recording *Rising Tide*). The recorded tour will be narrated by jazz pianist Billy Taylor. The show is being put together by a great guy, Asst. Curator Ken Moore.

While there, anyone seriously interested in musical instruments should also check out their permanent collection on the second floor.

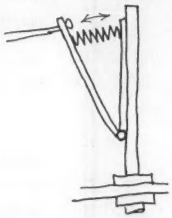
Bob Grawi

CONTINUING ADMIRATION of your fine publication — always a joy to receive and peruse.

Enjoyed the "movable toneholes." [*EMI Volume 11 #1, June 1996. This article discussed alternatives to toneholes for woodwinds, suggesting methods for progressively covering and uncovering an open slit running the length of the woodwind tube.*] I had a suggestion on how to improve upon the design. Maybe it might eliminate your breaking/stretching problem with magnetic strip: idea based on your design shown in Figure 2. Instead of a rigid eyebolts and nuts approach, something that would give when pressure is applied to the strip might be better. Thus —

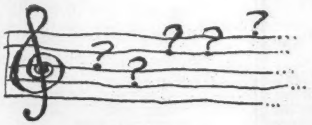


The diagram (I hope) is self explanatory. I think there is some technical name that I'm not aware of for the type of spring that I'm thinking of — when at rest the spring is closed and it is tense when open. Anyway, when a finger is placed along the length of the strip the hinge opens, and when the finger is removed, the spring draws the hinge closed again. I think this would cause less stress on your strip. Just a thought.



...Keep up the good work.

C. Reider



EVER THOUGHT ABOUT edible instruments? You can blow into an olive (a pitted one that is) for a high whistle. Make a green pepper ocarina. Popping corn as an auto-rhythm device. And the beauty of it is, after the concert, the musician and audience sit down to eat the orchestra!

Bill Sethares

NOTES FROM HERE AND THERE

Minnie Black, cultivator and crafter of gourds, well known and widely beloved member of the American Gourd Society, died on April 10 1996 in London, Kentucky, at age 96. Mrs. Black made wonderfully whimsical gourd figures and caricatures, gourd hats, and gourd everything-else, including an orchestra of gourd percussion and string instruments. Her work was featured in *EMI* Volume II #3, and her inimitable rendition of "The Monkey Song" appeared on *EMI*'s Volume II cassette tape. She'll be missed.

LESS THAN A YEAR AGO, we published the information that The World Forum for Acoustic Ecology had ceased publication of its *Soundscape Newsletter*. The newsletter was devoted to increasing awareness of the soundscape both urban and rural, and served as a networking medium among artists and scientists in the field. The newsletter has now been revived under the name *The New Soundscape Newsletter* by members of the Forum für Klanglandschaft, a German/Swiss regional organization associated with the World Forum for Acoustic Ecology. For more information, contact *The New Soundscape Newsletter* at Herrenwingert, CH - 8886 Mädris-Vermol, Switzerland; Fax +41 81 723-4950; e-mail 101570.1274@compuserve.com.

WE DON'T STOP PLAYING BECAUSE WE GROW OLD; we grow old because we stop playing."

That's Lou Berger in the photo below with his *Drum Shtik*, a rhythm instrument made in the tradition of the Devil's Fiddle. (For a history of the Devil's Fiddle, see Hal Rammel's excellent two-part article in *EMI* Volume VII #3 & 4.) Lou is a veteran of the player piano business, working for Story & Clark, the leading manufacturer of the instruments today. He originally designed the Drum Shtik as a promotional extra for player pianos, the idea being to give the musically untrained customer something

IN THIS ISSUE

EXPERIMENTAL MUSICAL INSTRUMENTS
For the Design, Construction and Enjoyment of Unusual Musical Sound Makers

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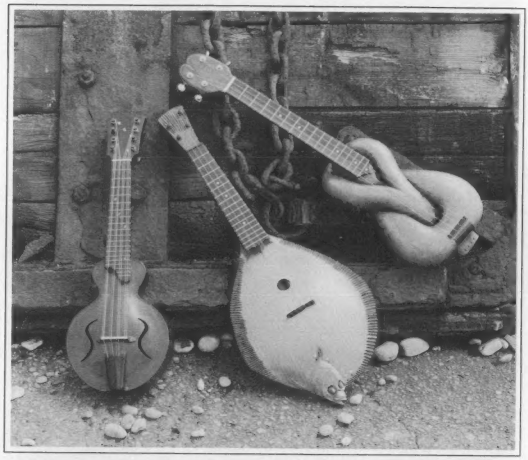
to play along with the player piano. Along the same lines, he developed The Player Piano Fun Center, a shelf unit that fits over the piano. It's made to hold not only the piano rolls, but musical spoons, kazoos, and similar items suggestive of musical participation.

Lou can be reached at Story & Clark by fax at (619) 569-8721.

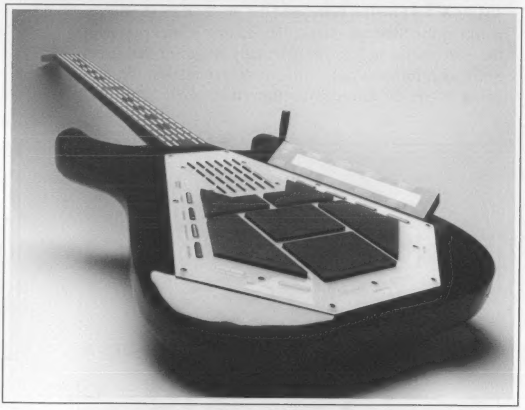
BRIAN STAPLETON, whose unusual and shapely ukuleles appeared in *EMI*'s November, 1991 issue (Vol. VII #3), recently sent this photograph [right] of some of his more recent work. From left to right: Arachnopatch, a double-course, nylon-strung uke hybrid; Flounderlin, a plaice/ukulele cross; and Enigmaphon, a steel-strung bari-uke/dulcimer mix of indeterminate tuning.

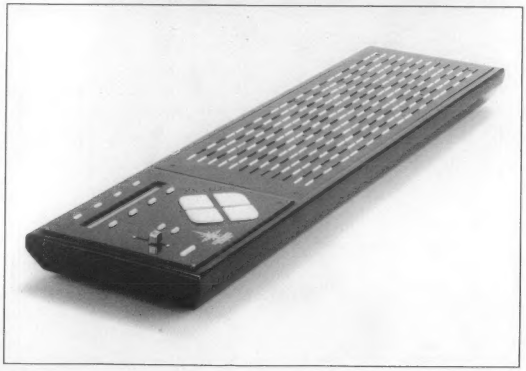


In *EMI*'s last issue (Vol 12 #2, Sept. 1996) we featured two articles on two-dimensional keyboard layouts — keyboards for electronic musical instruments taking the form of a two-dimensional array. One of articles was from from Jacob Duringer, maker of the MIDI-compatable, multi-timbral synthesizer controller known as the *Monolith*. The other was from Geary Thompson, who has developed tuning concepts for guitar and corresponding keyboard layouts for synthesizers based on relationships in musical fourths along the vertical axis.

Here now is the work of one more innovator in the field of electronic keyboard layout. Harvey Starr, of Starr Labs, has designed synthesizer controllers in the form of guitar-like instruments. (See the photo on the right.) Embedded in the neck, in place of the fretboard, are arrays of touch-sensitive keys layed out in a spatial arrangement analogous to that of guitar strings. Velocity-sensitive "Key Triggers," located in what would normally be the strumming or plucking region, can be used to start the notes. The instrument is typically played in a manner analogous to guitar playing. But with the flexibility afforded by an on-board computer, both the keys in the neck and the key triggers below can be programmed for different sorts of output information, so if the user wants to go beyond the guitar analogy, all kinds of things become possible.

Taking one step further the idea of a keyboard modelled after a fretboard, Starr Labs has also produced controller boards played in the manner of a conventional keyboard, called the Z-Board and the G-Board. As shown in the lower photo, these use thin, string-like rows of keys similar to those in the guitar, in a two-dimensional area twelve rows deep and just under two octaves wide. Once again, the instrument is user-programmable and highly flexible.





PHOTOS, THIS PAGE

Top: Three vairants on the ukulele, by Brian Stapleton Photo: David Maxwell

Center and below: Z-Tar and Z-Board from Starr Labs.

IN LAST ISSUE'S ARTICLE "The Art of Sound Effects, Part 1," by Ray Brunelle, we failed to provide proper credit for one of the photographs, so now — better late than never — I'd like to draw special attention to its source. The photo of the thunder screen on page 11 was taken with the author's permission from the book *Radio Sound Effects: Who Did It, and How, in the Era of Live Broadcasting*, by Robert Mott. (Published by McFarland & Company, Inc., Box 611, Jefferson NC 28640; 336 pages, with over 100 photographs and illustrations.) This excellent book made the *Choice Magazine* list of "Outstanding Books 1994." You'll find several more photos drawn from Mr. Mott's work in Part 2 of the article, appearing in this issue. We have also drawn from another of Mr. Mott's books, *Sound Effects: Radio, TV and Film* (Focal Press, 80 Montvale Ave., Stoneham, MA 02180.)

Robert Mott was himself a live sound effects artist during the golden age of radio, continuing in later years in TV. He has complemented his first-hand experience with exhaustive archival research in the field. The two books present a fascinating history, lucidly documented.

Two more essential sources for the article, and for anyone interested in the music of Spike Jones, were Jordan Young's *Spike Jones — Off the Record* and *Spike Jones: The Man Who Murdered Music* (Past Times Publishing Company, 1994 and 1995). Mr. Young has provided some additional notes and corrections on the subject matter which follow "The Art of Sound Effects, Part 2" on page 31 of this issue.

NEW WEB SITE ADDRESS

Experimental Musical Instruments has moved its web site. The new address is

http://www.windworld.com/emi

We're part of the *Windworld* bundle of web sites, associated with the excellent journal of woodwind making, *Woodwind Quarterly*. The site was designed by *Woodwind Quarterly's Scott Hirsch, in a manner reflecting his direct and common sensical approach to these things: it's attractive, easy to read, easy to find your way around in, and requires no long download times. Thank you, Scott.*

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For information on subscriptions, books and other material related to instrument explorations that we have available, see our ads in the Notices section and elswehere in this issue.

CORRECTIONS

In last issue's article "My Easy Stereo Tube-Preamp Leslie Talk Box," by John Herron, we gave John's address incorrectly. The correct address is 3635 South 544 East, Salt Lake City, UT 84106, USA. Apologies to John and to anyone who may have tried to reach him at the incorrect address — if you tried and did not get through, please try again.

We also have some corrections in connection with Part 1 of Ray Brunelle's article "The Art of Sound Effects." They appear following Part 2 on page 31 of this issue.

SOUND SYMPOSIUM

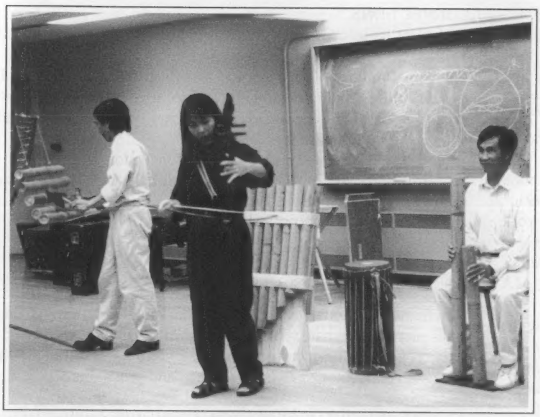
Newfoundland Sound Symposium, the sound-arts festival that takes place in alternate years in the city of St. John's, Newfoundland, saw its eighth incarnation in July of 1996. Hal Rammel, a frequent contributor to *EMI*, was there, and sends this report.

Once again the Newfoundland Sound Symposium provided an inspiring setting for the shared discoveries of muscial instrument exploration. I'll share these few notes with you focusing on this aspect of the symposium, acknowledging that I don't do justice to the full range of Sound Symposium 8's support of creative music from a global perspective.

Invention doesn't stop with design and construction. It exends into the techniques that make these objects work as musical instruments and, perhaps especially in improvised musical situations, must be an ongoing process in the mutual sound exploration of an improvised performance. This was fully evident in two particular performances this year. Percussionist Don Wherry (co-director of the Symposium with Kathy Clark) resided center stage for the opening performance of the festival with the ensemble The Black Auks. Don's vast collection of toys, found objects, and homemade contraptions (what set off those ping-pong balls in that steel pan?) sent the rest of the Black Auks off in all variety of directions. His obvious delight in this array and his exceptional abilities as a percussionist made their single continuous set flow in the most engaging manner. Several days later at the Ship Inn (one of the frequent sites of symposium events), Canada's long-standing improvising ensemble CCMC performed with members Michael Snow, Paul Dutton, and John Oswald. Both Paul Dutton's extraordinary vocal abilities (focused largely on sounds not normally associated with singing) and Michael Snow's actions on the body of the upright piano itself (using mallets, pie tins, and paper to extend the instrument's range) made this a mesmerizing performance.

The participation of London, Ontario's Nihilist Spasm Band in Sound Symposium 8 offered a resounding sonic boom to the presence of homebuilt instruments. John Boyle plays kazoos of his own construction (with multiple bells and mouthpieces, amplified and mixed with digital delay manipulated in real time). Murray Favro and John Clement play guitars of their own design and construction. Hugh McIntyre anchors the ensemble with his 3½-string bass. Art Pratten features his own electric violin, the Pratt-a-various, and vocalist Bill Exley adds a cooking pot with marbles in it to the percussion side of the band. Their Ship Inn concert resonated throughout the entire symposium.

Oslo-based instrument inventor Johannes Bergmark did a solo performance during an evening at the Arts and Culture



Above: Khac Chi, Ngoc Bich and Chau Yo of the Khac Chi Ensemble.
Below: Khac Chi and Ngoc Bich on Dan K'longput. Photos by Hal Rammel

Centre featuring his string stirrups. Suspended from two piano wires high above the stage, Johannes passes each string through a board strapped to his chest so that a second sounding length extends from the board to a stirrup on each foot. He creates thunderous tremolos with subtle leg movements, sustains long low tones by stroking the string lengths above, or plays higher harmonics near the inverted bridges on the board. Like a parachutist caught in a tree entertaining himself until help arrives, his performance somehow managed to appear both vulnerable and triumphant in the midst of a startlingly dramatic musical landscape.

I performed a duet concert with Johannes earlier in the week, improvising with electroacoustic sound palette, triolin, and devil's fiddle alongside Johannes' whalefish, finger violin, hedgehog, and metal harp (all of which have been described previously in *EMI*). We were pleased to have our performance recorded for rebroadcast by the CBC on Larry Lake's "Two News Hours," as were many of the Symposium concerts. Later in the week I presented a history of the devil's fiddle (and learned that the local variation is called an "ugly stick") with slides and live demonstration at one of the daily morning workshops.

The use of non-musical sound devices as the basis of musical composition is celebrated everyday at the Sound Symposium during the noontime Harbour Symphonies. These fanfares for the horns of ships in St. John's Harbour were created by different composers each day. Innumerable locations (along the docks, from the Old Battery, or high atop Signal Hill, for example) offered unique sonic and visual vantage points to these events scored this year by Rob Power, Don Wherry, Alison Carter, Adam Staple, Liz Picard, Tony Hall, Doug Carroll, John Wyre, John Boyle, Sainkho Namchylak, John Oswald, and Marc Sabat.

Another significant site for musical gathering was provided by Tom Hamilton's electronic environment installed at Wordplay Bookstore for the length of the festival. This installation, titled "Off-Hour Wait Station," became a most intriguing site for Symposium musicians to improvise together off Hamilton's constantly metamorphising electronic sounds. These informally organized sessions included just about everyone attending the festival and featured a gamut of conventional and very unconventional musical instruments.

The morning workshop and evening concert of the Vietnamese ensemble Khac Chi stimulated much conversation and speculation among instrument builders. Khac Chi, Ngoc Bich and Chau Vo are virtuosos on a wide range of unusual and beautiful string and percussion instruments largely unfamiliar outside of Vietnam. Their workshop presented detailed examination of the single-string dan bau (for which Khac Chi himself has designed a set of frets), the resonatorless two-stringed violin the dan ko ni (the strings connect to a membrane held in the player's mouth), and a wonderous percussion array of dan k'longput and dan dinh pa. Each deserves closer study in these pages.

Ongoing at the Arts and Culture Centre gallery was an exhibition currated by Gayle Young and Reinhard Reitzenstein called "For the Joy of It" featuring visual and sound works by five Ontario artists. The exhibit included guitars built by Murray Favro, John Boyle's painting "Spirit Rocks" to be studied while listening to an audio tape of amplified kazoos created by John Boyle, and Michael Snow's "Correspondence" mixing photo-enlarged typewritten pages with tape-looped typewriting superimposed on these written words. Harold Klunder and Catherine Carmichael installed material remains of ongoing versions of their sound performance "And To The Dreams That Come Between Sleeping and Waking."

As I said earlier, these fragmentary notes do little justice to the broad scope of music at Sound Symposium 8. In a musical climate that reflects both traditional and very experimental musical inclinations, Don Wherry and Kathy Clark (and their exceptionally competent support staff) succeed in presenting a festival marked by warmth and generosity, celebrating shared ideas and mutual discovery in an inspiring atmosphere that seems to extend far beyond the various sites of the festival to include everyone we met in St. John's. It was an unforgettable experience.

THE DEVELOPMENT OF BAMBOO SAXES FROM ARGENTINA

By Ángel Sampedro del Río
Translated by Mariana Cecilia Iglesias

Someone, sometime and somewhere might have thought for the first time to blow into a tube with a reed joined to it. We do not know who. Someone, somewhere came up with the idea of attaching a clarinet mouthpiece to a conical tube. We all know who and when it was — Adolphe Sax, 1840s.

His invention appeared at a time in which the development of wind instruments had undergone changes introduced by Theobald Boehm. Perhaps someone had done something similar before, with no success. Later on, someone applied the principle discovered by Sax to create a simpler instrument which changed the history's way. Again that person's name got lost in history.

Copying the conical shape with bamboo canes and joining a simple reed may seem obvious once it is done. I have references of people who did this. Undoubtedly, it was invented and re-invented in different places. Although the original name (saxophone) still remains, the bamboo version is a completely different instrument, probably belonging to the 20th century — if there were previous instruments, they got lost too. This kind of sax brings together the features of the brass sax with the aesthetic and acoustics of the bamboo.

Drawing by Robin Goodfellow

In my case, I was twenty when I set myself to this job. I started out in 1985 without knowing what a saxophone was like — in fact, I thought I had discovered the clarinet (I called it "aidófono"). At that time I was full of impetuosity and curiosity — which are still with me. At first, it was an empirical work, then I started really investigating what happened and why. But now I do both things.

My main aim was and is to achieve the best sounds only with natural materials. This developing process was at the same time acoustical and technical, gathering experience in the characteristics of bamboo, its treatment and finishing.

There are different varieties of bamboo cane in Argentina, but traditionally not all of them are used for musical instruments. In the case of my wife, Mariana García, and I, the passion for the canes led us to work with them for many purposes and to discover that some species are suitable for musical instruments.

WHAT IS THE BAMBOO SAX?

The technical description is easy. In the simpler case, a cylinder bamboo (or near-cylinder), with a reed attached makes a clarinet. This kind of tube, as you may know, does not emit the whole harmonic series (that is, the first overtone is not the octave of the fundamental mode, as it would be in a complete harmonic series, but rather the twelfth). In other cases, joining different bamboo sections of different diameters — building a shape which behaves acoustically like a cone — with an attached reed, we get the characteristic sound of a sax with the complete harmonic overtone series. The challenge in these last years, and the years to come, has been and will be to achieve a conical bore acoustically efficient, and at the same time, strong and durable. That is a "real" musical instrument.

MY WORK

Differences between a true conical bore and a segmented one took me on an empirical search of the best shapes and proportions. At the same time, I found it important to give the instrument a lasting quality comparable with other woodwind instruments. It is for this reason that I use different types of bamboo for the different sections (normally, three or four plus the mouthpiece).[1] The treatment with sealants, lacquer and oils complete the objective.

I have always had my mind set to "standardize" my instruments once I achieved a certain result. Of course, dealing with natural materials,

1. For example, the first section of the body of the instrument is a somewhat more "elastic" bamboo because it must resist the assembling and disassembling of the mouthpiece.

PHOTOS, FACING PAGE

Upper left: On the left, tenor bamboo sax in C with gourd bell, mouthpiece dismounted. On the right, long-mouthpiece sax in D.

Upper right: Aidófonos in D (left) and G (right).

Lower left: Baritone sax in G, with four keys.

Lower right: Moxeños. The bigger is in G, the smaller in C. The player blows through the smaller auxiliary pipes.

PHOTOS, THIS PAGE

Upper left: Fine tuning a bamboo sax in F with coconut bell.

Below right: Ángel Sampedro del Rio plays a tenor sax in F.
Photo by Paulo Campochiaro

this is relative. That is the reason why I find my work so attractive: all the pieces look alike but they are also distinguished from each other.

Anyway, I did not submit to work with the bamboo canes as they are found in nature, and so I modify their bore. At the same time, I am doing some research on mouthpieces — which may often be taken apart to adjust the pitch. Although most of the models I make have adapters which make it possible to attach conventional mouthpieces, my challenge was and will be, once more, to make mouthpieces out of bamboo, taking advantage of the different shapes of certain canes.[2]

These days I am devoted to the investigation of the mouthpiece and throat. The mouthpiece's angle is variable, tending to become acute for larger instruments — around 17 degrees.[3] Contradictory as this may seem, I do it in order to get an upper register and also give the sound stridency.[4]

With respect to fingering, it corresponds basically to the chart of the German recorder, but other fingerings may be possible. For some musicians, I make saxes according to the traditional *quena*[5] fingering. In others, I have inserted half tones in the major scale (e.g. E*b* and B*b* in the C scale). In every case, semitones can be obtained though cross-fingering or half holing. I always build them in the equal-temperament scale.

The holes vary in position and diameter in a fashion similar to a flute. They also vary in accordance with internal diameter; consequently, they differ according to the segment of the cone where each is found.

All the bamboo models I manufacture have at least one key, which is also made of bamboo, for the farthest vent which is also of the biggest diameter and so much more difficult to cover.

In some cases where it is justified by the harmonic response, I have added closed keys at the top of the instrument. They may achieve additional notes over second octave.

Though bamboo saxes possess good sound naturally, different bells made with natural materials give original characteristics to the tone and sonorous intensity. Coconut or gourd bells give it a wrapping and mellower sound. Cow or bull horn bells add stridency — reinforcing upper harmonics — and a louder sound.

Another eye-catching characteristic of saxes in general are the curves, so much so that people believe that this has a decisive influence in sound. But this is not so, and the reason for this particular shape is the convenience for playing. In my instruments, curves are made from hard wood which may be disassembled in larger instruments.

To sum up, the bamboo sax is an avant-garde instrument, clearly different from traditional brass saxes, whose aesthetic origin may

2: The principal cane that I use is Phillostachis bambusoides, called "tacuara" here in Argentina (Takuar is a god of the Guaraní Indians). I also use varieties of Sasa sp. (Japanese bamboo in Argentina), and Arundo donax (Castilla's cane) for reeds.

3: All my mouthpieces can be used with conventional Soprano or Alto reeds.

4: As happens with other instruments too, when you get an advantage (e.g. deep basses) you sacrifice other things (e.g. the higher notes), which may sometimes be achieved in another way. Obviously, a certain balance is searched for, sometimes tipped to one side or the other.

5: The quena is a flute of the ancient Inca, with 5 or 6 holes in the front and 1 in back (thumb), normally in the key of G or A.

be traced in other South American folkloric instruments. Its acoustics and possibilities make it a choice for musicians of all kinds.

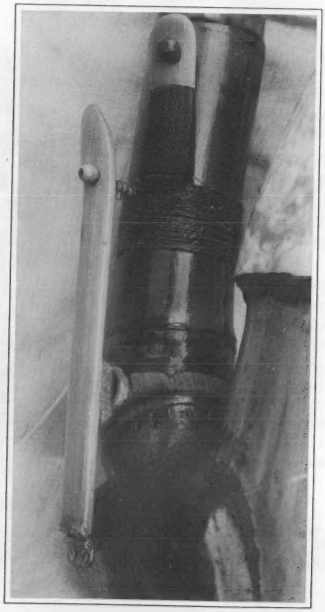
Bamboo Saxophones from Ángel Sampedro del Río

MODELS AND PRICES

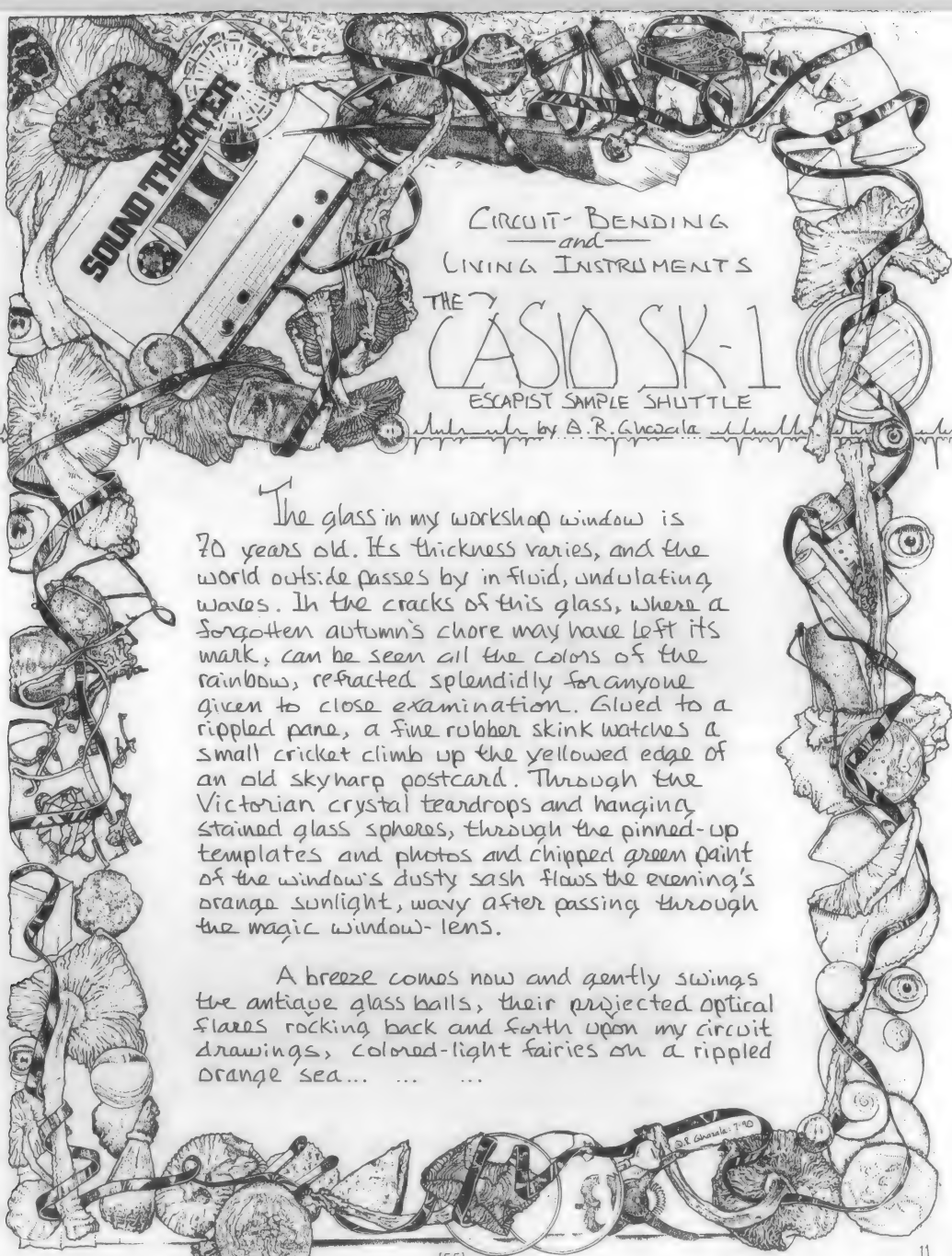
KEY	LENGTH	WITHOUT BELL	COCONUT OR GOURD BELL	HORN BELL
B♭	55cm	$110	—	—
G	65cm	110	125	140
F	72cm	115	130	150
CURVED				
F		—	165	180
E♭	105cm	—	185	200
C	122cm	—	230	300
B♭	Ask for availability			

Payable with bank check only, in U.S dollars or Argentine pesos.

All the models include case, fingering chart, reed, mouthpiece adapter and shipping (to America and Europe). For more information, don't hesitate to write to Ángel Sampedro del Río, Scalabrini Ortíz 1960, Villa Adelina (1607), Buenos Aires, Argentina. Fax [international code +] (541) 794-3880 (include the name Ángel Sampedro del Río at the top of the fax).



Detail of baritone bamboo sax by Ángel Sampedro del Río showing two of the keys.


SOUND THEATER
CIRCUIT-BENDING
—and—
LIVING INSTRUMENTS
THE CASIO SK-1
ESCAPIST SAMPLE SHUTTLE
by A.R. Ghazala
The glass in my workshop window is 70 years old. Its thickness varies, and the world outside passes by in fluid, undulating waves. In the cracks of this glass, where a forgotten autumn's chore may have left its mark, can be seen all the colors of the rainbow, refracted splendidly for anyone given to close examination. Glued to a rippled pane, a fine rubber skink watches a small cricket climb up the yellowed edge of an old skyharp postcard. Through the Victorian crystal teardrops and hanging stained glass spheres, through the pinned-up templates and photos and chipped green paint of the window's dusty sash flows the evening's orange sunlight, wavy after passing through the magic window-lens.
A breeze comes now and gently swings the antique glass balls, their projected optical flares rocking back and forth upon my circuit drawings, colored-light fairies on a rippled orange sea... ... ...
A.R. Ghazala '90

THE CASIO SK-1: Escapist Sample Shuttle

by Q. R. Ghazala

(continued from previous page)

The plans, today, upon which the fairies dance are those of the circuit-bent Casio SK-1.[1] Readers of this article series have inquired over the years about the viability of keyboard instruments as a focus for circuit-bending. While I'm inclined to think the end result of the bending process is often better suited to less linear sound machines, keyboards *were* an early target of mine, and the circuit-bent SK-1 is an exceptional example of deep-end anti-theory application combined with equal-tempered polyphony. Abstract sound fields thick and intriguing, complex voices, split keyboards, strange tone shaping and extended ADSR envelopes begin the list of new possibilities... but more on such things in a moment.

Casio's SK-1 introduced digital sampling to more individuals than any other sampler to date. The SK-1 began to appear on store shelves in 1986. For its time, at its price and with its functions, there was nothing else like it. Main features of this 32-note mid-size keyboard include:

4-note polyphony, available live and also in memory for digital record/playback functions of two types: 1) real-time 4-note polyphony, and 2) 3-channel multi-track memory coupled with a "one key play" system allowing notes in memory to be manually sequenced for editing purposes;

5 PCM voices, 1 user-sampled voice, 3 harmonic synthesis voices and one user-adjustable harmonic synthesis voice (this nice feature provides a tone in which most of the first 16 harmonics are present and can be adjusted in strength, with up to 14 levels of accentuation for each);[2]

Thirteen different preset ADSR envelopes which can be applied to any voice in use;[3]

Preset portamento and vibrato effects;

8 bit PCM sampling at 9.38 kHz (sample time is approximately 1.4 seconds);

Built-in condenser microphone for inputting samples, as well as two input jacks — line and external microphone;

Line-output;

Master tuning;

11 auto rhythms with chord accompaniment;

... and lastly, that button everyone dreads hitting by accident... the Demo Tune (which circuit-bending reconstructs in a wonderfully irresponsible manner).

No, it's not a hi-fi sampler. But thousands of people found the SK-1's audio quality good enough to keep interest on high for some time.

Plenty of SK-1s are still around today, patiently waiting to be reborn through circuit-bending. Since the resultant instrument is so exotic in its behavior, so intriguing in its sounds and so attainable through standard rewiring techniques, I'll devote this column to the SK-1's anti-theory transformation.

My first SK-1 was bought during its heyday at a price of around $90. I quickly made two modifications and, until lately, thought no further about altering it. These early changes resulted in two jacks being mounted on the SK-1's case. One was wired so that it would accept a remote sampling trigger to use in conjunction with an external microphone. The other jack was wired to accept programmed voltage pulses (such as those generated by drum machines) so as to trigger the "one key play" function thereby turning the SK-1's note memory into a nicely controlled sequencer. Push "start" on the drum machine and both it and the SK-1 perform in tight synch. Fun.

Years pass... the SK-1 is overshadowed by industry changes and pushed to the back of the shelf (go take out those batteries!). Few things tend to encourage a circuit-bending experiment more than finding a promising target device at a bargain price. Especially if the device is a duplicate of an item you already own and care for, and is one you'd like to bend but are hesitant for fear of damaging it in the process. So I was thrilled to recently find a SK-1 (with a key missing) for only $1.50 at a thrift shop. Oddly, several days later I found another SK-1, this time in great shape and costing $5.00 at a different second-hand shop. The one with the missing key became my prototype, the $5.00 unit became the finished instrument and my original SK-1 remains as it was before.

Following the usual process of circuit-bending, the instrument was expanded upon to the degree of now providing 28 new controls (switches, dials and body-contacts), 7 micro green & red LED logic pilots and an ultra-bright sound envelope LED... 36 modifications. With all the added controls turned off, the SK-1 operates as normal. The modifications are easy to find and are open to anyone familiar with the use of a soldering pencil (small, low-wattage soldering iron).

Once again, the creative short-circuit is on the loose, the repercussions of its catalytic anti-theory wreaking indeterminate digital havoc within the all-too-proper halls of previously strict program logic. The new controls were discovered one of two ways. Either by listening to the instrument's voices while 1) using a wire to momentarily connect arbitrary circuit board points to each other (this giving rise to 20 of the 22 circuit-bending switches, their purpose being to implement and combine the creative short-circuits just found), or 2) using *fingertips* to connect arbitrary circuit points to each other (the 3 body-contacts and 2 of the 3 dials [potentiometers or *pots*, variable resistors] were found in such a way).

1. "Circuit-bending" refers to the process of creative short-circuiting by which standard audio electronics are radically modified to produce unique experimental instruments. A further description of these techniques can be read in *EMI* Volume VIII #1, 1992.

2, 3. PCM (Pulse Code Modulation) is a high-quality means of digital audio data processing. ASDR (Attack-Decay-Sustain-Release) describes the four main parameters of sound envelope transients as commonly addressed in electronic synthesis techniques.

This last activity, touching an active circuit-board with the fingers to hear what changes occur in the sound, should be done only with low-voltage, battery-powered circuitry. Circuits containing large capacitors or step-up transformers are to be avoided. These are simple to recognize; check out a beginner's electronic project book if unfamiliar. These components usually appear in various types of lighting circuits, practically never in the audio electronics appropriate for circuit-bending. At any rate, the idea is that interesting sounds arising from finger contact can be hard-wired into existence by soldering a pot (variable resistor) between the two points so discovered. The middle solder lug of the pot is wired to one circuit point, an outside lug of the pot to the other circuit point. After all, that's exactly what your body is doing in the same situation. As the electrical energy is conducted through your flesh its potential changes as you vary the resistance presented it by adjusting the pressure of your fingertips on the circuit-board. You've become, in essence, a variable human resistor (aren't we all?). Conductivity will differ from individual to individual, so there is no exact recommendation I can give as to the resistance rating of the pot. Experiments with a 500K will provide a good starting point.

My SK-1 circuit-bending applications fell into 9 sections. These are the IMAGE GROUP of 9 switches, the SKEW GROUP of 7 switches + 1 pot, the BODY CONTACT GROUP of 3 brass spheres, the PITCH control dial, the POLY control dial, the AXIS GROUP of 3 switches, the RESET GROUP of 2 switches, the LOGIC PILOTS GROUP of 7 LEDs + on/off switch and, lastly, the SOUND ENVELOPE LED. None of these expansions of the SK-1 were hard to find. Following are brief explanations of these new circuit-bending discoveries, as well as guidelines for implementing the changes yourself.

IMPLEMENTATION AND BEHAVIOR OF THE CIRCUIT-BENDING EFFECT GROUPS

For persons interested in experimenting on their own SK-1s, my descriptions below assume the working orientation of circuit is such that the underside of the board faces the experimenter and that the parallel grouping of three large (28 pin) ICs is to the bottom left (on reverse of board). In this position a medium-sized electrolytic capacitor is situated at the top right corner of the circuit-board. This needs to be relocated elsewhere within the case (on insulated wire extensions) to open up room behind it for new controls to be mounted.

TWO NOTES OF CAUTION

1) Though it seems I haven't harmed any normal functions of my 3 SK-1s, there's no guarantee that a connection I didn't try exists that could damage or destroy the circuit. In the same vein, manufacturer's design changes can create a situation in which a previously trusted circuit-bending connection becomes either inoperative or destructive on a later model. Therefore, while my instructions are valid in pertaining to my SK-1s, they may not be advisable for yours.

2) The bending procedure requires a great deal of soldering tiny wires to very closely spaced IC pins protruding through the underside of the board. Very careful connections need to be made in order to avoid creating solder bridges between the pins. Quick connections are also a good idea so as not to overheat the internal IC electronics connected to the pin. I use a 30-watt grounded soldering station with long, tapered, 1/16" wide chisel-tip on the soldering pencil. For point-to-point connections I use insulated bought-in-quantity 30-gauge "wire-wrap" wire, the wilder color the better, and lead-free silver electronic solder.

IMAGE GROUP

These 9 switches to the right of the keyboard are interconnected between various pins on the furthest to the left of the three ICs mentioned earlier. Experiment to find these connections and others. Turning these switches on singly or in combination will create up to 8-step sound envelopes, up to five keyboard split points (different sounds assigned to various key groups), oddly evolving tone clusters and extended decays lasting up to 30 seconds or more. The multi-step sound envelopes may combine voices from the SK-1's menu or create new voices, changing voices, strung end-to-end and finally settling upon an unusual sustained tone, or slowly fading away. Additionally, choosing a different voice from the menu may completely change the effect of a given IMAGE switch.

SKEW GROUP

These seven switches and 1OK pot make connections between various pins of the same large IC and a common point on the bottom right-hand side of the board, that being to a pin on the 14-pin chip just to the left of a board mounting screw. Again, experiment. Essentially, the five main SKEW switches connect five pins of the large IC to the smaller IC by running through one of the other two smaller switches in the group. This signal also passes through the 1OK pot. The pot adjusts the strength of the signal passing between the two chips, and the smaller push-button and toggle switches allow the choice of either intermittent or continual use of the chosen SKEW effect while playing. So if, say, SKEW switch 1 is turned on, a connection is made between a pin on the large IC and the pin on the smaller one. The intensity of the effect is governed with the SKEW pot, and the musician controls the duration of the effect with the two miniature actuation switches. The SKEW effects are similar to the IMAGE effects with the addition of adding pulsings to final voice segments of multi-step sound envelopes. Assorted sustains, echoes, repeats, doublings, choruses and harmonic distortions also arise from the SKEW effect group.

BODY CONTACT GROUP

These three brass balls are wired to three circuit traces just to the left of the master tuning trim pot soldered into position in the center of the board. Primarily pitch controls, bridging with a fingertip the gap between the center sphere and the one to its left will lower the frequency. Bridging the gap between center and right will raise the frequency. Actually, just touching either outside sphere will bend the frequency, but not as dramatically as when bridging the gaps as mentioned. Very nice real-time vibrato and pitch-bend are possible in this way. Beyond this application, a moistened fingertip pressed across all three contacts will bring on an assortment of deep-end audio calisthenics simply impossible to describe! *Tech Note*: On a crowded circuit board it can be hard to tell just which traces your fingers are touching to create the audio changes heard during this process of exploration. Holding

Circuit-bent Casio SK-1, final model. Notice AXIS switches and PITCH dial on left front of case, HARD and SOFT RESET switches on far left edge of case and LOGIC PILOT swich on back of case. Also note seven logic LEDs along top case edge and amidst control buttons as well as envelope LED located at bottom left of speaker grille.

a metal jeweler's screwdriver in each hand will allow you to touch obvious and specific traces on the board. Electricity will flow into one screwdriver, through your body and out the other screwdriver back into the circuit. Varying hand pressure on the screwdrivers will allow you to observe the effect of changing resistance between the two potential body-contact points.

PITCH DIAL

This is simply a 500K pot wired between the two outside body contacts. Decreasing the resistance raises the overall pitch of the instrument.

POLY DIAL

Another 500K pot, this one is connected between the right-hand lug of the SK-1's on-board master tuning trim pot and any of a number of potential traces on the board. Try traces an inch or so below center mounting screw. When the resistance is decreased, a note or two of the polyphony will slowly fade out. This control is used to adjust the degree of polyphony, especially valuable when applied to the dense abstract sound fields generated through other circuit-bending controls.

AXIS GROUP

These three switches connect a pin on the large left-hand 28-pin chip (again) to three pins on the two 28-pin chips to its right. Many possibilities here... experiment! Drastic voice changing in the form of distant ethereal sounds, rich tonal swells, seemingly chance music cycles, metallic percussive bursts and endless de-tuned sustains are a few of the effects created by the AXIS GROUP.

RESET GROUP

These two switches represent a choice of "HARD RESET" or "SOFT RESET". As I've stated before, the unusual anti-theory design system of circuit-bending can create digital exasperation in logic routines, otherwise known as program crash. When the circuit-bent SK-1 crashes (and it will), four reset options are available. Casio's front panel "RESET" button might work. If not, turning the SK-1's main power switch off and back on might work. If both of these fail, my "SOFT RESET" miniature push-button on the left side of the case could solve the problem. This makes the same connection as IMAGE switch 2. During initial prototyping I noticed that this connection could reset certain crashes without powering-down the unit. Yes, I could just flip IMAGE switch 2 on and back off, but the mini push-button is easier, quicker, and more out of the way while playing. The "HARD RESET" is a "push-on/push-off" switch situated next to the mini switch just mentioned. This is the deep crash remedy since it completely breaks the circuit between the power supply and the board. Therefore, it is also a MASTER POWER switch. This is the standard reset I include on many circuit-bent instruments prone to crash. Can you keep a secret? It does the same thing as the tiny reset switch you're instructed to push with a pencil tip in case of malfunction of your calculator, answering machine, musical keyboard and lots of other digital whatevers. Yep, the Big Guys' theory-true toys crash deep enough all by themselves to need as drastic a thing as battery disconnection to set them straight again too!

LOGIC PILOT GROUP

This group of seven miniature red or green LEDs is implemented by connecting the anodes (+ leads) of the LEDs to various pins of the large right-hand 28-pin chip. All LED cathodes (- leads) then connect through a LOGIC PILOTS power switch (on back of case) to the negative side of the power supply. The switch to turn them off is needed for two reasons. First, if left on they continue to drain power unless my added master power switch (HARD RESET) is turned off. Second, certain IMAGE switches overdrive the LEDs when turned on, risking eventual burnout. These LEDs flash mysteriously as logic levels (voltages) go high or low as the instrument functions. These can also be considered STATUS LEDs, and can be quite informative when gotten used to

on this and other circuit-bent instruments. I've drilled holes for these along the top of the SK-1's case with a few also mounted below, amidst the control buttons. Circuit connections for these are discovered the same way as switch connections. Simply use LEDs with alligator clip test lead extensions in place of the usual short-circuit exploration wire. Remember that LEDs are polarized semiconductors: if an LED won't light, try reversing its leads and reconnecting it to the circuit. If an LED glows too brightly or gets hot, try connecting a resistor (experiment around 100 ohm) between the LED's anode and the circuit.

SOUND ENVELOPE LED

This clear, bright, red LED (2,000 mcd) is connected across the speaker terminals and fluctuates with the intensity of the sound without disturbing sound volume or clarity (which is not always the case with this parallel wiring scheme). LEDs can also be connected in series with a speaker if more energy is needed to drive them. Sound envelope LED connection points can also be found by attaching one LED lead to a speaker terminal and then touching an extension of the other LED lead to various parts of the active circuit. In fact, such envelope LEDs can be driven by points discovered on the board having no direct connection to the speaker whatsoever.

As noted before, circuit-bending the SPK-1 does require a good deal of careful work since tolerances of both soldering and component placement are tight. Much more is possible than what I've done. Still, a person might want to add, say, only a body-contact and leave the rest of the SK-1 untouched.

Any newly-bent instrument presenting significant sound forms deserves a visual transformation as well. Once the holes were drilled to accept the new switches, pots, LEDs and body-contacts, I painted the case of my circuit-bent SK-1 a hi-gloss fire engine red. Over that went a flat black crackle coat. This is a type of paint that contracts and cracks apart as it dries, leaving an organic-looking and somewhat fractalized pattern. From far above the case a sweep in the air of holographic micro glitter (several specks could fit in the dot of this letter i) was rained down onto the housing, falling like a star field across the scarlet veins in the black crackle field. These tiny particles reflect a brilliant spectrum of light, shifting hue in unison as viewing angles change.

A high-solids clear gloss final coating was then applied. This deepens colors, serves as a sealant and provides a surface upon which an extra-fine-tip opaque paint marker can be used to label the new controls, and re-label the old, their having been painted over in the refinishing process. New controls are then mounted, unit is reassembled and wiring is begun. With the SK-1 I decided not to refinish either the case bottom or the strip above the keys that contains envelope symbols.

Be forewarned that if you decide to dismantle the entire device to refinish the case as I've done, the keyboard "trees" need special handling. All the keys, in separate sets for white and black, are connected to a common tree and remove as single units. It is the junction of key-to-tree that is very fragile and must be handled with real care. It takes little force to bend a key out of alignment or snap it off completely.

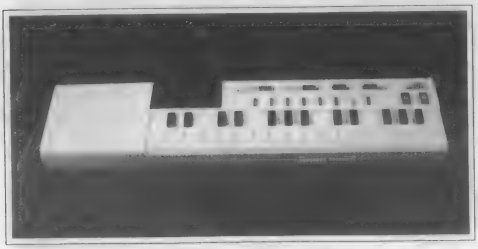
Exploring the SK-1 circuit is fascinating. In the EFFECT GROUP discussions above I've only begun to describe the major effects available within the separate groupings. Not only can each group be depended upon to produce many more effects than those covered, when multi-group combinations are experimented with (e.g. IMAGE switches 1,3,7 + SKEW switches 2,3 + AXIS switch 1 while touching body-contacts or sweeping POLY dial), the surprising nature of circuit-bending's ability to always generate new audio behavior becomes evident. My initial examination of such switching combinations produced 30 strong variations using the PIANO voice alone.

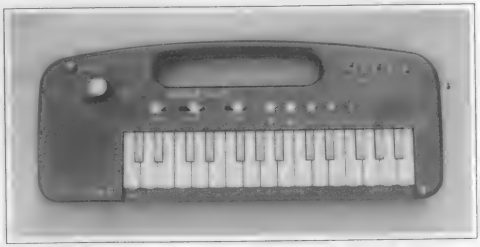
On some deep-end settings the circuit-bent SK-1 becomes an aleatoric music box, evoking outlandish chance compositions. Other settings turn the keyboard into an alien sound field generator, intercombining curtains of relatively pitch-free noises. Peculiar mixtures of countless types emerge as one moves deeper into switching possibilities... and I now find myself in the position again of trying to describe the eccentric, many-nuanced voices of circuit-bending. Like trying to define a rare flavor or shifting color.

As it often is with circuit-bending, these more extreme settings impose a control/non-control balance that can take some getting used to. Program crash is often inevitable under these conditions. Charting patch settings and sequences goes a long way to establish reliable interactions (see Cynthia Striley's patch chart application, next page), but the temptation to go a step further and see what happens is always there. I accept, even enjoy the non-control aspects of circuit-bending, feeling that they add to the mystery, and knowing that they are an integral part of the whole fascinating process that I've grown to enjoy so much. I'm reminded of the orange evening light through my wavy glass, and the prismatic fairy-flares dancing along its crests upon my SK-1 plans as I sat down to begin writing this article.

I'll admit I thought for a moment of turning on the overhead drawing lamp, chasing the light fairies away so I could better see my notes. But you know, I didn't.

(More overleaf →)





More circuit-bent keyboards from Reed Ghazala: In addition to the SK-1 described in this article, Reed has creatively re-wired the Casio VL-Tone on the left above (notice sixteen dip switches and envelope LED) and the *Universe Device* on the right (notice the five voice-bending switches, clock [pitch] control and body contact).

Contact Reed Ghazala at The Anti-Theory Workshop, c/o Sound Theater, 3325 South Woodmont Ave., Cincinnati, OH 45213, USA.

Websites: http://www.iac.net:80~cage/reed.html.
Coming soon: http://www.anti-theory.com

E-mail: qrg@anti-theory.com

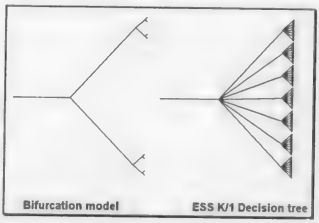
COMPOSING ON THE ESCAPIST SAMPLE SHUTTLE

By Cynthia A. Striley Ph.D. with Mark Milano

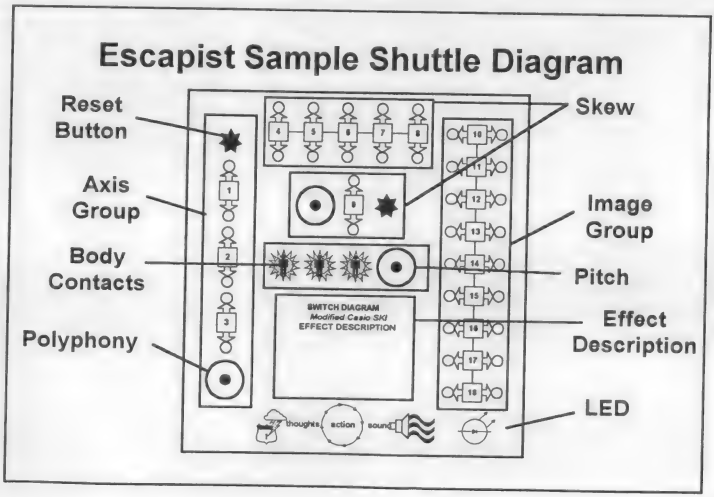
Some people find comfort in the predictable. I work in a field where things are often unpredictable. As a synthetic organic chemist, I march through chaos to pull out little pieces of order. Although my job requires me to find reproducible ways of preparing and purifying substances, the number of variables to be considered can be astronomical. Some find beauty in the ordered while they despise the chaotic. Conversely, I see the chaotic aspects as limitless possibilities or as the dream that has not yet been dreamt.

When I am not working in the lab, I enjoy creating sound landscapes. As a member of the ensemble Architexture, I was able to incorporate many different types of sound into our improvised works. I have worked with tape collage, samplers, synthesizers and various acoustic instruments. Since I had always been attracted to electronically produced sounds, I decided to build an instrument that I was curious about: the Theremin. After building and playing the Theremin, I realized that I enjoyed the Theremin's chaotic tendencies. Soon thereafter, I became acquainted with Reed Ghazala and his circuit bent instruments. At my Ph.D. graduation party, members of the group Architexture and other friends played a nocturnal concert in the woods behind my parent's house. At that party, Reed handed me an Incantor (modified Speak and Math). I soon found that the Incantor was like no instrument I had ever known .... I realized that not knowing exactly what the Incantor would do next was a positive aspect, not a negative one.

Some time later, Reed let me borrow a modified Casio SK-1 sampling keyboard or the Escapist Sample Shuttle (ESS 11). I was intrigued since I had worked extensively with the original SK-1 and SK-5 since their release. I found that the ESS K/1 with its numerous additional switches and dials was much more complex than the Incantor. With much experimentation, I found that there were some reproducible effects, but it was difficult to keep notes, so I developed a diagram. Although the diagram appears abstract, it actually mirrors the physical layout of the ESS K/1. I liken composition on the ESS K/1 to traveling on a path which branches off into several possible choices, each of which can be followed in turn to additional points of departure. Switch and dial positions are important, but the order in which they are flipped is also key. This diagram is simply a notepad or an interface for dealing with the instrument's inherent complexity.



Above: Decision making with the Escapist Sample Shuttle.



THE CITARA, type Alfonso el Sabio

A Medieval Psaltery

By Nelly van Ree Bernard

INTRODUCTION

In 1974 I founded the Dutch vocal-instrumental consort *MUSICA IBERICA*. From the moment we started to sing and play medieval music, I as a harpsichord and clavichord player missed an appropriate and suitable string instrument for this early Iberian music. I thought of having a psaltery, being the forerunner of the harpsichord (my main instrument at that time). As psalteries were quite unobtainable in Holland, I decided to make my own reconstruction of one of the psalteries depicted in the 13th century manuscript of the *Cantigas de Santa Maria del Rey Alfonso X el Sabio* (Songs in praise of Mary of Alfonso X the Wise). This is the manuscript identified as ms bI2, in El Escorial, a famous library in the monastery 'San Lorenzo del Escorial' (in the province of Madrid); founded by Philip II (king of Spain from 1554, son of Charles V). Alfonso X the Wise was king of Castilla & Leon from 1252-1284.

I finished my first reconstructed psaltery in 1975: the rectangular canon entero represented in the miniature belonging to cantiga 80 in that manuscript. In the years following more reconstructions saw the light of day. In 1986 my eight psaltery and three early clavichord reconstructions were ready.

The psaltery I will describe here is the citara that I identify as type NvRB-29. It is reconstructed after the miniature preceeding the notation and text of cantiga 290 in the above-mentioned manuscript. My design wass ready in 1982, whereupon the instrument was constructed in the workshop of Martin Sassmann (Germany) in 1984.

FIG. 2

The word 'citara' and related names, such as zither, zitter, citera, cithara, cither, cedra, cítola, citole, cister, cistre, cittern, cithren, chiterna, chitarra, etc., have been used in the course of time for different types of chordophones, either with or without a neck.[1]

FIG. 1

RECONSTRUCTION OF A CITARA DEPICTED IN MS BI2 OF THE CANTIGAS DE SANTA MARIA DEL REY ALFONSO EL SABIO [1221-1284]

The main source for the reconstruction of this psaltery in the shape of half a Romanesque window was the instrument depicted in the miniature belonging to Cantiga 290 [Fig. 1, drawing after miniature 290] in the 13th century Spanish manuscript just mentioned, the *Cantigas de Santa Maria del Rey Alfonso X el Sabio*. Although the name 'citara' has been used for different types of psaltery, I decided to use this name for my above-mentioned reconstruction. In manuscript bI2, however, no instrument names occur.

The source of this type of psaltery is uncertain, but it might be of oriental origin.[2] Quite a number of instruments depicted in the manuscript of the Cantigas had been imported from the Orient during the Moorish occupation of the Iberian Peninsula in the Middle Ages (starting with the Arab invasion in 711). In the 13th century Persian-Arabian instruments occupied a very important place on the Peninsula.

There are several earlier and later representations of similarly shaped instruments, such as:

1. A psaltery or harp played vertically in a Carolingian ivory carving [MR 370, Louvre, Paris, end of the 8th century; see Hugo Steger, *Philologia Musica*, Wilhelm Fink Verlag, Munich, 1971] Fig. 2.

2. The *Alia Cythara Jheronimi* in Sebastian Virdung's *Musica getutscht*, 1511 [Documenta Musicologica, Faksimile-Nachdruck, Bärenreiter, Kassel, 1970]. Fig. 3.

3. The *Cithara Hieronimi* in Michael Praetorius' *Syntagma Musicum*, 1619 [Dokumenta Musicologica, Fak-

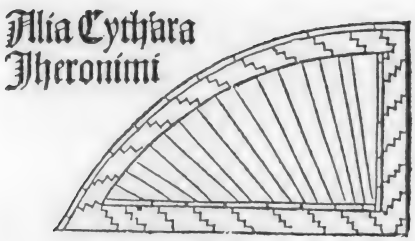
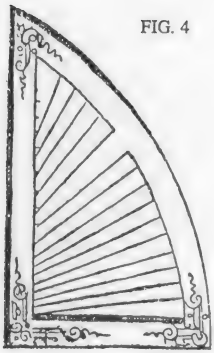


FIG. 3

FIG. 4



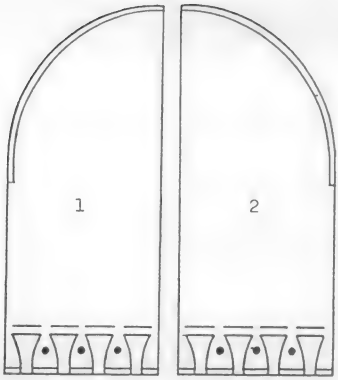


FIG. 6

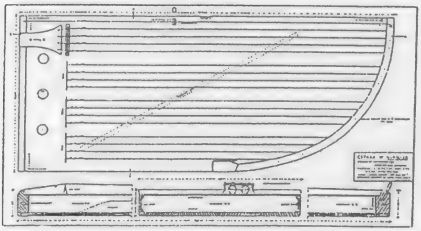


FIG. 7

RECONSTRUCTION OF A MEDIEVAL PSALTERY

a. CITARA, Cantigas de Santa María del Rey Alfonso el Sabio, 13th century, cantiga 290, folio 260 r, MS b12 /E^1, El Escorial.

b. CITARA, reconstruction Nelly van Ree Bernard, NvRB-29, 1982, construction firma Martin Sassmann, 1984. The Psaltery, pp. 43-48, 109-110, 116, 134-139, ISBN 90.6027.609.4/610.8, 1989.

FIG. 5

simile-Nachdruck, Bärenreiter, Kassel, 1958] Fig. 4.

N.B. It is impossible to ascertain, however, whether the citharas mentioned under 2 and 3 are harps or psalteries.

Problem concerning the position of the shortest strings on the miniature belonging to cantiga 290.

Comparing different depictions of musicians playing a psaltery, we see that most of the time the shortest strings — the highest in pitch — are on the lower side. The citara belonging to cantiga 290, however, shows the shortest strings on the upper side. As I was accustomed to having the highest notes on the lower side on my other psalteries (and on the guitar) I hesitated for a couple of years before starting this reconstruction, fearing that I would not be able to play the instrument as depicted in this miniature [Fig. 5]. Finally I decided to propose two versions, one being the reverse of the other, supposing that it would not make any difference in the sound [Fig. 6, versions 1 & 2].* The version chosen by me was the one on the right-hand side of Figure 6. The design being reversable could be beneficial to left-handed players; they could either use citara 1 in figure 6 (the *Cantigas* version) in left-handed position with the longest strings uppermost, or citara 2 in figure 6 (my version) with the shortest strings uppermost.[3]

The Result

The result of the hypothetical reconstruction of the citara from the manuscript b12 of the *Cantigas de Santa Maria* is a flat rectangular-shaped wooden case measuring 72.3 x 31.3 x 5.4 cm with one of the corners rounded off. The bottom board is made of poplar; the wrestplank, the hitch pin block and the sides of maple. Spruce (*Fichte* in German) is employed for the soundboard; while the four bridges are also of maple. On the short straight side there are three soundholes between the brass string holders. I added an unpretentious painted decoration to the soundboard (a few small flowers around the soundholes, in the middle of the soundboard and near the wrestplank). Sixteen metal strings grouped in fours run in parallel over four rather high bridges; each group of four strings has its own bridge near the brass string holder. The string holders are fixed with screws on the bottom side of the case (see the working drawing in Fig. 7). The range is from c to b'; the tuning is diatonic with b-flat and b'- flat as well as b and b'. From bass to treble the strings are grouped as follows:

c d e f	g a b♭ b	c' d' e' f	g' a' b♭' b'
brass strings	steel strings - - - - - - - - - - - - - - - -

N.B. Concerning the strings: The monk Juan Egidio de Zamora, a famous 13th-14th century theorist also known as Johannes Aegidius Zamorensis or Juan Gil de Zamora, in his *Ars Musica* (ca. 1300, Vatican) recommends the use of brass and silver strings for the psaltery.[4] In the 14th century anonymous Persian treatise *Kanz al-tuhaf* [0.2361, British Museum, London], metal strings are mentioned for the *qanun*, the semitrapezoid psaltery.[5] In his *Jami' al-alhan fi 'ilm al-musiqi* [MS 1842, fol. 78, written 1418, Bodleian Library], Abd al-Qadir ibn Ghaibi (d. 1435) prescribes twisted copper strings for the tricordally strung courses of the *qanun*.[6]

N.B. Concerning the case construction: In the above-mentioned *Kanz al-tuhaf*, wood of vine or plumtree is prescribed for the *qanun*, while for the *nuzha* (the rectangular psaltery) red willow, shah-wood, boxwood and cypress are named.[7]

Tuning

A Pythagorean tuning in perfect fifths is appropriate for this medieval type of instrument. The procedure for tuning the strings by fifths and octaves would be as follows.

a → d; d → d'; d'→ g; g → c c → c'
c' → f; a → e'; e'→ e; e → b; f →b♭;
[perfect 4th]

Tune the remaining f', g', a', b♭', b' with their lower octaves.

Some of the strings have colored marks. The b-flat strings have a 3cm-wide red mark on the area boundaries (see the description of these areas later under Playing methods), and the c and f strings have a 3cm-wide blue mark. These marks aid orientation on the playing board. (I used Testors Pla Enamel, which doesn't affect the tone quality).

An extra string with movable bridge has been added on the bass side. It can be employed as 'drone' or 'bourdon' string. In its total length this string is tuned to note G, though notes B and A can be obtained without retuning the string, using the movable bridge. This string is also meant for tuning purposes (as a built-in monochord); the string divisions are marked under the string with pencil on the soundboard.

If sharps are required, small removable bridges can be placed under the strings in question at specific points near the wrestplank.

EMPLOYMENT AND PLAYING METHODS

The citara can be employed as a solo instrument, and as an accompanying instrument for songs; but is also quite suitable for medieval music in consort. Medieval monophonic and two-part music can be played on this psaltery. Even four-part music could be executed on this instrument, with two voices per hand (in the horizontal position). If 'unisoni' appear in the composition the interpretation will be less effective because of the single stringing.

The citara is a plucked psaltery. The most favourable positions for this instrument are found by trial and error with the help of early illustrations. Seated on a low stool of ca. 40 cm high, the citara can be positioned as follows:

1. Vertically on the left thigh with the strings running vertically [Fig. 8].

2. Semivertically in the player's lap, the case more or less obliquely in the direction of the left knee [Fig. 9].

3. Horizontally on the player's lap [Fig. 10].

To prevent the psaltery from slipping a wash-leather is placed under it.

Usually the strings are plucked with the fingertips; the right hand, however, can use a quill (a very long plectrum made of a

*As Figures 8 – 10 show, the author has had version 2 shown in Figure 6 built. While she herself has not had version 1 built, it's possible that others who have purchased the plans have made version 1, converting the drawing of version 2 into the mirror image. (In Figure 5 a reverse print is used to allow the comparison between the author's reconstruction and the original miniature).

bird's feather, Fig 11). It is sometimes advisable to selectively damp off a string after sounding it, if the sustained ringing of adjacent pitches makes the melody sound less clear. The strings may be plucked in different areas of the playing surface to make the best use of the two hands, and for different tone qualities (Fig. 12).

The instrument was constructed after my working drawing in the workshop of Martin Sassmann (Germany) in 1984. After a period of experimenting I presented this instrument during concerts or lecture demonstrations in Canada, Germany, India, Italy, Poland, Spain and the United States. Musical examples played on this instrument can be heard on:

1. cassette NvRB-51, accompanying the book *The Psaltery, an annotated audio-visual review of different types of psaltery*, by Nelly van Ree Bernard (NvRB-47, Frits Knuf Publishers - Buren, the Netherlands, 1989 [168 pages]).

2. compact disc NvRB-54A.CD, Nelly van Ree Bernard, *Early Iberian Music and Sephardic Songs, psalteries, clavichords & recitation* (Eurosound Studio's - Herveld, Holland, ES.47.166 CD, 1995).

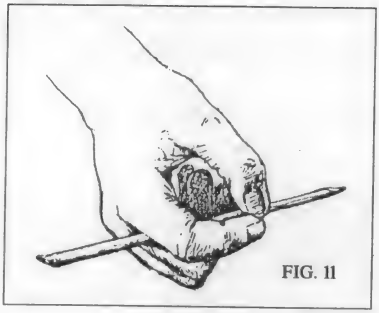


FIG. 11

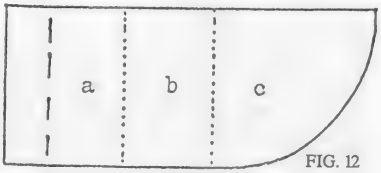


FIG. 12

The working drawing NvRB-29 [scale 1:1], 1982, as well as the two publications mentioned above can be ordered from Nelly van Ree Bernard, Muziekcentrum 'Het Duintje', Binnenweg 6, flat 209, 2121 GX BENNEBROEK, The Netherlands. Tel./Fax +31.23-584.6126.

FIG. 8

FIG. 9

FIG. 10

Nelly van Ree Bernard was born in the Netherlands in 1923 and grew up in Spain, where she gained her piano diploma at Academia Marshall in 1945 (Barcelona). She studied guitar for a couple of years with Alfredo Romea (Barcelona). She finished her studies in Interior Design in 1949 (Amsterdam). She studied harpsichord with Jaap Spigt (Amsterdam) from 1960 onwards and spent a year (1968/69) in India studying Hindustani music with Dr Premlata Sharma (Varanasi). After her return from India she gradually changed from harpsichord to clavichord and she began to concentrate on 16th century Spanish music, greatly helped by Dr Santiago Kastner (Lisbon). She formed the vocal-instrumental ensemble MUSICA IBERICA and began to re-design 'lost' early instruments (various types of psaltery and very early clavichords), which were built after her working drawings by different instrument-makers in Germany and Holland. She reconstructed the playing methods of the 'reborn' instruments, recording the different aspects in publications and on LPs, cassettes and CDs. Since 1966 she has been organizing concerts, lectures, courses, exhibitions and demonstrations of instruments, at her music centre HET

DUINTJE (Bennebroek, Holland), where about 70 European and non-European instruments, including her own reconstructions (three clavichords and eight psalteries), were permanently on show for visitors until 1993. From 1986 to 1993 she has been a board member of HET NEDERLANDS CLAVICHORD GENOOTSCHAP (The Dutch Clavichord Society, founded in 1986). Besides in Holland, Nelly van Ree Bernard has also been musically active in Austria, Belgium, Canada, Germany, India, Italy, Norway, Poland, Portugal, Spain, Switzerland and the United States.

ENDNOTES

1. See Curt Sachs, *Reallexicon der Musikinstrumente*, Georg Olms Verlag, Hildesheim, 1964; pp. 78, 79, 82, 84; Sibyl Marcuse, *A Survey of Musical Instruments*, David & Charles, London, 1975, pp. 177-234; José, M. Lamaña, *Los instrumentos musicales en los últimos tiempos de la dinastía de la Casa de Barcelona*, Anuario Musical, vol. XXIV, 1969, Barcelona, 1970; Rosario Alvarez, *Los Instrumentos Musicales en los Códices Alfonsinos: Su Tipología, su Uso y su Origen. Algunos Problemas Iconográficos, Revista de Musicología*, vol. X, No 1, pp. 67-104, Madrid, 1987; *The New Grove Dictionary of Musical Instruments*, ed. Stanley Sadie, vol. 1, Macmillan Press Ltd, London, 1984, p. 374; *Lexikon Musikinstrumente*, ed. Wolfgang Ruf, Meyers Lexikonverlag, Mannheim, Wien, Zürich, 1991, p. 80.

Some scholars, including Sibyl Marcuse, use the name "Zither" as a family name for different types of stringed instruments without a neck, whereas others use the name "Psalterium" (psaltery) for these instruments.

2. See Rosario Alvarez, *Los Instrumentos Musicales en los Códices Alfonsinos*, op. cit. pp. 73, 74].

3. For another depiction of the Cantigas version, see Nelly van Ree Bernard, *The Psaltery, an annotated audio-visual review of different types of psaltery*, Frits Knuf Publishers, Buren, NL, 1989, p. 110, fig. X-c. For another depiction of my version, see *The Psaltery*, p. 110, fig.X-b.

4. See Beryl Kenyon de Pascual, *Los Salterios españoles del siglo XVIII, Revista de Musicología*, vol. VIII, 2, p. 307, Madrid, 1985; Mary Remnant, *Musical Instruments of the West*, B.T. Batsford Ltd, London, 1978, p. 28; and D. Kettlewell, *The Dulcimer*, doct. thesis, Loughborough University, UK, 1976.

5. See H.G. Farmer, *Musikgeschichte in Bildern*, III, p. 100, 1951.

6. See H.G. Farmer, *Studies in Oriental Musical Instruments*, first series, p. 14, 1931.

7. See H.G. Farmer, *Studies in Oriental Musical Instruments*, first series, pp. 12, 13; 1931.

SPIRALLED GOURD TRUMPET (drawing by Gwendolyn Jones). The long-necked dipper gourd from which this trumpet was made was trained to the spiral shape as it grew. At maturity it was dried, cut open at the ends, cleaned, decorated and provided with a reinforcing ring and a trumpet mouthpiece. The tone is dull because the interior of the gourd is rough and not sufficiently reflective, but it does produce reasonably well defined resonances at tones in agreement with the lower part of the harmonic series.

SLÅ PÅ TRÅDEN

Music on Transport Wires

by Atle Pakutsch Gundersen

This article tells a story from a very remote part of the world, in any sense. Norway is a tiny little piece of land making up a shore towards the North Sea; a part of Scandinavia. On the west coast of this country the landscape takes on dramatic proportions and sometimes stunning beauty. Long and narrow *fjords* with mountains rising directly and almost absolutely straight up from sea level and up to more than 1500 meters. These landscapes are some of this country's very few tourist attractions. I was living there for six years working as a teacher.

As time went by I discovered that the cultural landscape of this region was even more stunning than the landscape itself. How could it be possible that there were farmhouses in the middle of the mountain side? There were no roads of course; sometimes not even a path. Still they would have kettles, and kettles would need food. Hay. The answer was the transport wire. By a well developed network of transport wires they could move anything (even the kettle itself) up and down the mountain sides without trouble. Once established, this system generated a whole culture of its own. Since the length of the wire could exceed the range of the human voice, signals would be needed. 'Slå på tråden' (from Norwegian language) means literally to knock on the wire, and this is presicely what was done. Different 'codes' for every need gave a large number of signals. Though modern agriculture no longer gives room for such methods and small scale kettlery, this system is still alive in some rare places in Norway. Later in history, when the telephone spread to everywhere, the expression transfered to that new system of wires. Nowadays, 'Slå på tråden' is a commonly used phrase in Norwegian for using the telephone.

When this system of transport wires caught my attention, I went out to examine them for myself. What I found profoundly baffled me. First I merely used my wedding ring to lightly knock on the wire. The wire responded with a sonorus bell-like sound full of sustain and rich in overtones. But the real surprise came when I put my ear directly on the wire. To hear what was going on 'inside' was a big experience for me. Tremendous reverb. Bouncing echoes. Glissandi traversing the total spectrum of hearing and even further downwards into sub-bass. I clocked the duration of one knock to more than 40 seconds of beautiful decay.

Soon I found myself experimenting with different items for attack. I found (probably through my interest in playing the musical saw) that a bow gave interesting results, especially when used *sul ponticello* (bowing adjacent to the bridge, or, in this case, at the wire's end-point). The wire would always have a spot or two between the support stone and the winding mechanism where high pitched overtones would give scintillating resonances in the main part of the wire. This and knocking with a triangle beater were to become my main methods for playing on such wires.

For a long time (one year or more) I was just amusing myself with these experiments. But after I had talked with several people about it, a more definite aim took form. I started to systematically explore the possibillity for the realization of a concert event employing transport wires. To my astonishment, the responses I got went contrary to Norwegian custom of turning anything new down. Mr. Dagfinn Bach at Vestlandsforskning (research center) was the first to positively respond to my idea. He put me in contact with a guy in the Norwegian state telephone company, who also responded positively to the ideas. (I was by then totally numb from all this positiveness and convinced that it had to stop soon.) Another friend then put me in contact with his brother who happened to be the director of a big annual jazz festival in the city Bergen (in the same part of the country). I was shocked when he proposed to make 'the event' a commission from the festival. Anybody who has knowledge of how new music and new art in general is treated in small small countries like Norway will understand that this is almost surreal. I lost conciousness, and then started to work.

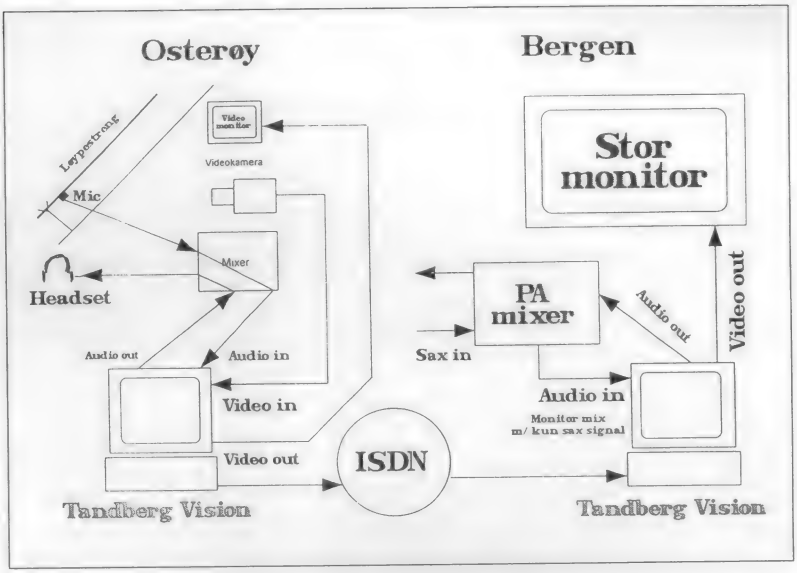
After having one single rehearsal with the other musicians I had chosen (a sax quartet), it was concert day. The saxes sat on stage at the concert hall in Bergen. They had the sound from the wire through monitors and digital video of me on a big video screen. The screen could be seen both from the stage and from the audience. The images had a peculiar nature due to the slow 'upgrading' of signals on this special type of equipment, called ISDN, which both sends and receives video and audio signals through the same physical optical telephone wire. Special components for signal compression and de-compression are required. The images reminded me of slow motion video, but kept magically synchronized with the sounds. They were a fascinating combination of 'bad-tech' and high-tech.

I was situated several miles away from the concert hall, outdoors on a very old farm (now a museum) playing a transport wire of 200 meters and more than 100 years old. My idea was originally to 'hook up' several wires making a whole 'Harp of Transport Wires', but this proved to be out of range technically at that stage of development and will remain a dream for future possible events. The sound from the wire was picked up by a contact mic and sent to a mixer standing in an old shack. There the sounds and video were connected to the special telephone system. It took several hours to set up the system, but it proved to be almost 100% reliable. No fuzz from Norwegian telephone companies. The concert went off OK. Unfortunately the DAT recorder broke down during test runs, so no recordings were made.

And, according to the custom here in Norway, the event was totally ignored by both the people in the composers organisation and the press. No reviews appeared. Only some photos from a newspaper shot the day before (announcing the event) remain for the archives, together with letters, drawings and scores for saxophones.

And, of course, the transport wires themselves are still there for everybody to enjoy. Both before and after this episode my music has centered itself around artifacts from the cultural landscape. I have made pieces for flagpoles, subway tunnels, river noise organ, stone avalanches, sheeps with bells, car mechanic tools etc., etc. ... sometimes to the annoyance of neighbors, but always to the total ignorance of the 'music scene in Norway'. But as long as they keep out of my way I'm happy. Happy with the joy of just doing it. Currently I'm working on a piece for electric guitar and fog horns, hopefully to be realized within a year or two. I'm thrilled by the tremendous power of those horns, and curious about whether it will be possible to match their level with a huge stack of guitar amplifiers. This is fun !

I would love to make contact with people around the globe who might have interests similar to mine. Please write or e-mail me for reciprocal joy!



Atle Pakusch Gundersen is a composer & performer from Norway. He can be reached by mail at Kollåsveien 50, 4900 Tvedestrand, Norway, or by e-mail at tgunder@sn.no

GRAPHICS, THIS PAGE

Above: Diagram of the sound and video hook-up for the Slå På Tråden concert.

Below: The author and a transport wire. The image is a photocopy of newspaper photo — one of the few surviving documents of the event.

THE ART OF SOUND EFFECTS

Part 2

By Ray Brunelle

Dedicated to my Father and the memory of my Mother and Brother, who got me started in all this.

This is the second part of a two-part article on the history of sound effects in theater, film and music. Part 1 appeared in our last issue (*Experimental Musical Instruments Volume* 12 #1, Sept. 1996). Some additions and corrections to Part 1 appear on page 31.

I believe the golden age of sound FX was the 1900s through the Vaudeville & Burlesque era and into the days of early Radio & TV. Comedians and performers in Vaudeville and Burlesque often called upon the drummer to accentuate highlights in their routines or execute a sound effect for a gag or pratfall (which literally means "a fall on the buttocks"). It's such a classic mode of inherited expression that it's still used today. Just watch David Letterman or any other talk show. Inevitably there always seems to be a point in the dialog which elicits a "Badda, Dum ...." or a cowbell clunk from the drummer.

As stage productions and acts grew more elaborate these early show drummers were called upon to come up with more inventive and outrageous sound FX. During the silent film era not only did theaters have a pianist or organist to accompany a film but they often had SFX artists behind the screen creating sounds to accompany the picture. (Fig. 9)

Johnny Cyr (another drummer Spike used on occasion) recalls playing for silent pictures as a boy of 9 or 10 years old with his violin teacher, a piano player and himself on traps and sound effects.

In Japan during the silent film era there were men called "benshis." A benshi was a man who stood on stage next to the screen and not only did the dialog for both the men and women on the screen but the film's sound effects as well. These men were so popular that many people just came to see the benshis no matter what film was playing. Watching them do the ranting of an outraged emperor, the protestations of his suffering wife and the growls of the royal Pekinese *all in the same scene* was well worth

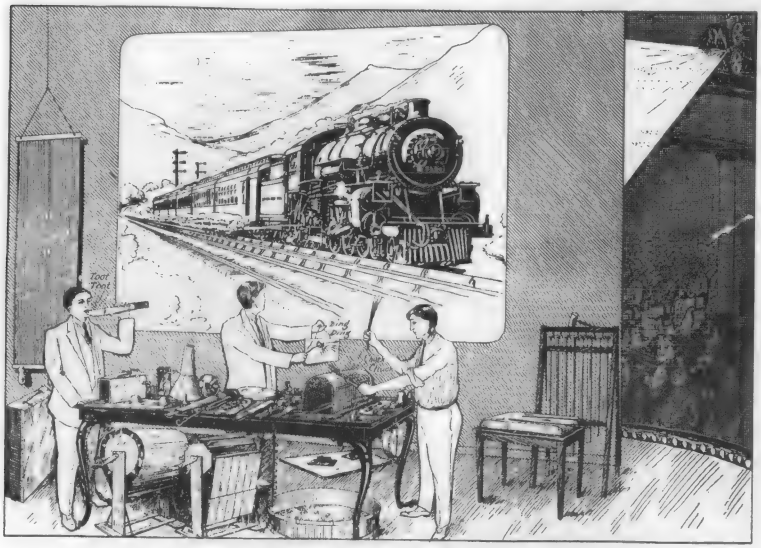


FIGURE 9.

Scene from a Yerkes promotion. The caption reads "The Picture ... shows A Practical Demonstration of the simplicity and effectiveness of YERKES' SOUND EFFECTS. Audience delighted with the absolute realism of the Picture. If you use YERKES' SOUND EFFECTS, you need not worry about box office receipts."

Courtesy of William Ludwig, Jr.

FIGURE 10. Items from the 1910 Yerkes catalog. Courtesy of William Ludwig, Jr.

the price of admission.

The Yerkes Mfg. Co. provided many devices for the sound effects field. These illustrations are taken from a rare 1910 catalog, graciously loaned to me by Bill Ludwig Jr. (Figure 10)

As Vaudeville began to die out and Radio came to be the more popular form of entertainment, many of these show drummers and their traps were recruited to do sound FX for radio (and later TV), adding a sense of realism that suggestive dialog alone could not create. Prior to the use of sound effects in early radio broadcasts, some directors and producers resorted to confusing dialog like "I wonder why that car is stopping in front of my house?" Of course the audience didn't actually *hear* a car drive up. It was decided that the use of dialog to describe sounds couldn't continue, and what was needed was for the audience to actually hear the sounds (or what they imagined were the actual sounds). Radio turned to the sound effects that had been used in

theatrical productions for countless years, and adapted and improved on them for broadcast use. SFX helped relieve radio's incessant talking and allowed the audience to use its imagination.

Whenever a producer needed an effect to help get an idea or mood across or to add more realism to the story, it was the sound effects men and women who had to create that illusion, whether by using the natural characteristic sound of an object, or an imitative, suggestive, or implied sound.

Ora and Arthur Nichols are regarded as the two people most responsible for bringing sound FX to Radio, bringing several sound effects props from their many years of theatrical and silent film experience. Arthur once spent nine months working fourteen hours a day to build one multiple-effects device. It had nine-1/8 horsepower motors, one 1-horsepower motor, and tanks of compressed air for operating all the bird and boat whistles. The machine was five feet high and two feet deep and could reproduce sounds ranging from a small bird chirping to 500 gunshots a minute.

There were, however, producers that insisted on using the real thing instead of something which sounded like and easily passed for the original sound. On one occasion, Orson Welles was doing a radio play for the Mercury Theater On The Air. The play took place in the desert and he had the floor of an entire studio filled with sand because he wanted the actors to do their own footsteps instead of a sound effects artist mimicking their steps in a sand box. He later realized this was a bad idea because he had to turn the mics up so loud that they picked up every little noise in the studio and the actors dialog overloaded the mics.

On another occasion there was a scene which called for a man to be cutting his lawn, so he had half the studio filled with sods of grass with the actor pushing a real lawn mower instead of the "normal" way this effect was done, which was feeding strips of newspaper into a more compact, stationary version of a lawnmower. The only problem was — *Orson couldn't make the grass grow between the rehearsals and the live broadcast.*

The advent of real sound effects recorded at the source and put onto 78 rpm records greatly aided the sound effects artist in his work, along with other electronic devices. These were invented to replace manual or imitative effects, some of which either took up enormous amounts of space, or were unreliable or awkward to use. Some of the sound effects departments in these radio stations were massive. At one point CBS had 40 people working in its sound effects department, and the prop rooms were overflowing with equipment and devices to make sounds. (Fig. 11 a, b, & c)

Some of the more common early manual effects were different size wooden doors and frames (even metal car doors), and large single-headed drums containing buck shot which provided the sound of ocean waves when slowly rolled around. The sound of rain was created by a device that dropped bird seed onto a piece of stretched wax paper. Footsteps in the snow were created by filling a large shallow box with cornstarch and walking in it. There were Splash Tanks for creating watery FX, Wind Machines (which produced blustery wind-like noises), "Nail Pullers," Barking Dog FX, Lion Roarers, and innumerable other devices adapted and invented.

FX for creating locomotive sounds were made with a "scratch box," which was a shallow wooden box and a piece of tin with holes punched in it. (There were many variations.) (Fig. 12)

By rhythmically sweeping a stiff wire brush over the holes a steam engine chugging effect could be produced. Directors expected this chugging sound to accelerate rapidly as the train pulled out of the station and continue for as long as needed, or until the artist's arm fell off, which is why sound effect departments relied so heavily on hiring drummers.

Sadly and unfortunately I've learned from Mr. Mott that most of these effects and special one-of-a-kind props have either been demolished and thrown away by the studios, or stolen. There has been some talk about creating a museum for these priceless artifacts which have played such an enormous part in the history of theater, Radio and TV, but nothing has been established so far.

The need for more sophisticated SFX that couldn't be

FIGURES 11 A, B & C (this page and following page). Sound effects in use and in storage at the CBS studios.
This page's photo is from the book *Sound Effects Radio, TV and Film* (Focal Press); those on the following page are from *Radio Sound Effects* (MacFarland); both by Robert Mott. Used here by permission.

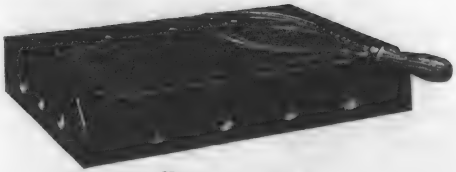
produced by the old manual FX used in the theater became a problem in the early 30s, and many artists began recording sounds on 78 rpm records. Unfortunately, sound recorders in those days were about the size and weight of a large washing machine, and the sounds were limited to those that could be produced in a studio. Soon, more portable equipment was developed that enabled the SFX artists to go in the field to record realistic SFX, and Radio was given another element of realism.

In order to use these new sound FX records, modified phonograph players with two tone arms were made. They had potentiometers in them so that if you needed the sound of wind or waterfalls behind a long scene, you played the sound with one pickup arm, and as the needle was coming to the end of that cut you cross-faded, slowly turning down the sound from one pickup while turning up the sound from the other pickup arm which was placed on the beginning of the same cut. (Fig. 13)

In addition to this double-arming capability, the motor speed could be increased or decreased with a potentiometer control, which added a great deal of potential variety to a sound. A recording such as the Mogambi Waterfalls could produce such varied sounds as gunshots, surf, traffic (by adding horns), or a jet airplane. It was even used as the sound of an atom bomb exploding in a news broadcast by SFX artist Robert Mott.

Sometimes you practically had to be an octopus if you were using several records for a show. If there was only one effect needed from each record, you ran the risk of not picking up the needle in time and playing a fog horn in the middle of a jungle skit, as each record usually had a few different, unrelated sounds on it.

Another problem was that as this method caught on, the same car crash and skid could be heard on consecutive different shows. It was realized that more varieties of a particular sound were needed. This was eventually solved by advancements in making recording equipment more portable so that SFX artists could go just about anywhere on location and



Heavy service type
For use in Bands and large theatres

PHOTOS THIS PAGE

Above: FIGURE 12. Perfection Railroad Imitation

Below: FIGURE 13. Two-armed phonograph
(Photo from *Radio Sound Effects* by Robert Mott [MacFarland]. Used by permission.)

Above right: FIGURE 14. Foster gun
(Photo from *Radio Sound Effects* by Robert Mott [MacFarland]. Used by permission.)

Below right: FIGURE 15. Clavivox (Photo courtesy of Irwin Chusid)

record more varied sounds.

Another advent was the development of re-recording technology. In 1933, on the soundtrack to *King Kong*, Murry Spivak (head of the SFX department at RKO) used this technique to create and manipulate SFX for King Kong. He recorded the sound of a lion roaring, then took that back to the studio and re-recorded it at half speed (dropping it down an octave) and then mixed in the sound of a tiger roaring backwards. The result was stunning, as no one had ever heard an effect like that before.

Purely synthetic sound originated with the work of Reuben Mamoulian in the 1932 film *Dr. Jeckyl and Mr. Hyde*. His effects included exaggerated heartbeats, reverberating gongs played backwards, and expressionistic bells. In addition, he experimented with direct optical recording, using the Fischinger system of painting the track edge of the film with light photographed to create frequency patterns which produced sounds upon playback. (For more on this and related techniques, see Hugh Davies' entry under "Drawn Sound" in the *New Grove Dictionary of Musical Instruments.*)

Another company that specialized in manual effects and

instruments was the Carroll Sound company. They sold such exotic things as: "Marching Men Effect," hand-crank air raid sirens, NBC chimes, "boing boxes," musical saws, boo bams (a percussion instrument made out of tuned bongo heads with square wooden resonators and laid out like a marimba), and many other wonderful devices. I don't know when they started (40s-70s?) or what caused their decline. I can only assume it was the advent and advances of electronic technology like Makenzie Carts, synthesizers and samplers that caused their demise.

Makenzie Carts were an endless tape loop/cartridge system, which could be cued up instantly with whatever pre-recorded sounds you wanted and mixed simultaneously with other carts. Each Makenzie machine had five tape mechanisms and other Makenzies could be stacked and linked together.

One unusual electronic device from the early 50s that was used in radio and TV was called "the Foster Gun", invented by SFX artist Don Foster. (Fig 14). The sounds from this were so realistic that the Marine Corps was interested in using it to accustom new recruits to the sounds they might encounter in battle. It could produce everything from a single shot to a machine gun, or a ricochet to an explosion, all at the flick of a switch to find the proper frequency. Prior to this, blank or "starter" pistols were used, but were proven to be dangerous and unreliable. Not only could the flame from the barrel cause burns, but "fiery spitballs" from the wadding shot out of the barrel, and they often misfired on air, too. One story goes that a blank pistol jammed during a live broadcast. The stunned sound effects artist was rescued by a quick thinking actor who ad-libbed "Shooting's too good for you. I'll stab you instead, like this!"(Of course at this point the gun suddenly went off.)

The Foster Gun could also be triggered by sound. If the sound was intended to be heard off camera it was triggered manually by the SFX artist. If a gun was intended to be seen on camera, the sound of the blank pistol (with less powerful charges) could trigger it. Unfortunately, it couldn't discriminate between a blank pistol or any other sounds of the same volume, so the Foster Gun was eventually retired.

Some of you may be familiar with the music of Raymond Scott. He licensed a lot of his compositions to Warner Brothers, where they were re-orchestrated by Carl Stalling and used in their "Merry Melodies," "Looney Tunes," and other cartoons. Not only was Scott a prolific composer, but an inventor as well. In 1948 he invented a $10,000.00 device called Karloff, which could imitate chest coughs and wheezes, kitchen clatter, the sizzle of a steak frying and jungle drums. Another was the Circle Machine which was used in an Autolite commercial to simulate the sound of a storage battery dying, ending in a short circuit. It was reported that it sounded like "a 23 second breakdown of a Lilliputian merry-go-round followed by a soft string of firecrackers." The Circle Machine consisted of a motor-driven disc with a series of switches positioned around it, each of which triggered a specific sound effect.

Another device was an analog waveform generator. It had a ring of incandescent lamps, each with its own rheostat, and a photoelectric cell on a spindle that whirled in a circle above the lights. As you turned the rheostats down to dim or brighten the individual lamps, the output of the spinning photoelectric cell would change, altering the shape of the generated waveform.

Other devices he invented were the Serial Doorbell ('66), a synthesized Chinese gong ('68), and the Clavivox, which was a keyboard device designed to simulate a Theremin (it was actually made of two Theremins). It could accurately do portamento slides smoothly from one pitch to another on the keyboard without a break in the sound. (Fig 15)

In the 1900s, early electronic musical instruments were being built which also had sound FX capabilities. In 1906 Thaddeus Cahill debuted his Telharmonium, which was an early type of tone organ. The early Telharmonium concerts included several classical pieces, imitations of instruments, and sound effects, such as the passing of a drum and fife corps. (For a full history of the Telharmonium, see Reynold Weidenaar's recently published *Magic Music from the Telharmonium.)*

Sound FX have also been used as complete musical compositions. A group of Italian composers called *Futurists* wrote music for machine guns, steam whistles, sirens, and other noisemakers as early as 1912. The Futurists were among the first composers to include noise as an inherent part of the music, not merely as a side effect with traditional instruments.

Today Sound FX are a big business and more important than ever. Motion pictures often devote several tracks for Sound FX and Foley work. The term "Foley" was coined in the 50s from the work of sound editor Jack Foley. Jack didn't actually invent the techniques (as they were commonly used), but was credited with them because some directors had seen Jack adding live sound effects to a film (as opposed to laying them down in post production later). They liked it and wanted to implement sound FX "the way Jack Foley did it," and that's how the term caught on. According to Mott, if you were making a film in Mexico and needed an effect synced live, the term was known as "Garcia-ing", after the name of the post production sound person who was known for that technique there. In Italy, it would be whatever the last name of that person was, etc. It just so happened that the term "Foleying" caught on and is universally accepted now.

Sound FX have been greatly enhanced by the advent of electronic sound-processing equipment, with the evolution of sound effects devices from early electronic musical instruments through to present-day digital effects. Some of these sound-processing effects include reverb, the Echoplex (an analog tape delay), flangers, fuzz boxes, phase shifters, and octave dividers (I think Jimi Hendrix was credited for spawning some of these), not to mention synthesizers, etc. Today it's happening more in the digital domain with computers and powerful sound processing software, such as Arboretum's *Hyperprism* for the Macintosh (named after one of Edgard Varèse's compositions), which has many different reality-bending FX. This amazing software processes sound in real time by drawing a "Path" in a "Process Window." Depending on which point you are in a window, it yields a different dimension and/or intensity of the effect. Macintosh PPC users can download a working demo at http://www/arboretum.com/.

There are also many other dedicated FX processing devices and musical instruments. These include such as Kurzweil's K2500 series sampler workstations, which give you the ability to record, edit and process sounds and save them as a completely new waveform, and Emu's *Vortex*, which can "morph" from one effect to another.

A whole industry has sprung up around sound FX. Today there are several manufacturers offering libraries on Audio CD, CD ROM for Macs & PCs, and other dedicated (and interchangeable) file formats, containing thousands and thousands of sounds from normal everyday FX to alien atmospheres. And there doesn't

seem to be any end in sight. (I've even seen one CD of different car doors closing recorded in different environments!)

They say "a picture is worth a thousand words" ... but the people who first married sound effects with actions to help tell a story created an art form and spawned an entire industry the end of which we will probably never see, thanks to creative sound FX designers, inventors, editors, Foley artists, software developers, instrument manufacturers and many others in the industry in search of that perfect sound.

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*NOTE: Mr. Ludwig does a lecture/presentation clinic called "A History of Percussion" which covers the drum from Colonial times, through three wars and into the silent movie era, and ends with a demonstration of sound effects for a Radio play. For more information contact: Wm. F. Ludwig II — Consultant, 1080 Nerge Rd. #106 Elk Grove, IL 60007

Back cover from a percussion catalog circa 1910, showing George H. Way and George B. Stone with animal sound effects. Photo courtesy of Rob Cook

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Ray Brunelle is a drummer, composer, inventor and Sound FX designer whose credits include sounds for Arboretum Systems, NED/Synclavier, Intelligent Music Software, Amiga World Magazine, The Other Guys Software, Dr. T's Music Software, iMedia Communications, OSC's "A Poke in the Ear with a Sharp Stick — Vol. III" (AIFF CD ROM for Mac), and a contract with Kurzweil Systems to produce sounds and CD projects for their K2500 series workstations. He's composed music for the University of Lowell on Computer Robotics which won an award from NASA, and music for other projects which were funded by the New Hampshire State Council on the Arts and the National Endowment for the Arts, and received credit as a SFX consultant for a "live" radio show produced in Worcester, MA which was picked up by NPR. He's been the subject of three NHPR interviews, and helps produce personalized children's tapes for Disney/Cake & Candle Productions. One of his cymbal designs was also manufactured by the Zildjian Cymbal Co.

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(See additional notes next page)

ADDITIONAL NOTES AND CORRECTIONS TO PART 1

Since Ray Brunelle's "The Art of Sound Effects, Part 1" was published in our last issue (*EMI* Vol. 12 #1, Sept. 1996), we have received additional comments from some of the knowledgeable people in the field.

Jordan Young, author of *Spike Jones — Off the Record* and *Spike Jones: the Man Who Murdered Music* (Past Times Publishing Company, 1994 and 1995), writes:

Parker Cornel was not the only TV SFX man who worked with Spike. Ray Erlenborn worked on Spike's TV shows and LPs.

Spike was of course inspired by earlier bands [as indicated in the article], but he never publicly acknowledged their very existence, let alone admitted their influence.

Although Joe Siracusa had a lot to do with the SFX on the cartoons mentioned in the article, he was in fact an editor. Earl Bennett (AKA Sir Frederick Gas), bassist Roger Donley and band boy Skip Craig all followed Joe from the City Slickers into the editing department at UPA, home of the Magoo cartoons.

Mel Blanc worked with Spike only once — on "Clink Clink Another Drink," one of the band's earliest recordings.

As far as Spike being the first to make funny SFX in music popular, no. The Hoosier Hot Shots was a very popular group that preceded him by a decade.

Additional corrections: Ted Hering, another generous source of first-hand information for the article, appeared in our acknowledgments with an extra R in the surname; apologies to Ted for the error. The name of the radio actor who supplied the voice of Elmer Q. Fudd was incorrectly spelled; the correct spelling is Arthur Q. Bryan. As noted in this issue's letters column, we failed to credit the source for the thunder screen photo appearing on page 11; it was taken, with the author's permission, from *Radio Sound Effects: Who Did It, and How, in the Era of Live Broadcasting*, by Robert Mott (published by MacFarland & Co., Inc., Box 611, Jefferson NC 28640).

JUST INTONATION AND MY EXPERIMENTS WITH MUSICAL INSTRUMENT BUILDING

by Jeff Bunting

It took a long time for me to really catch on to what Just Intonation is fundamentally about — even after reading about it and learning a lot of factual information and even after hearing examples of music played in Just Intonation. If you've always been used to western music it takes a while to become sensitized to the "in-tuneness" that Just Intonation has. It has its own psycho-acoustic effects. I have found that it is much more potent at inducing a meditative state. In my case, building instruments has been a large part of the process of becoming sensitized to Just Intonation, and it has been getting more interesting the more I become familiar with it.

My first instrument, the Electric Twelve String Slide Guitar, is a very good instrument for playing chords in Just Intonation. There are a variety of tuning schemes that I have experimented with where chords can be plucked with the fingers or strummed with a pick and then transposed with the slide. When I was trying out different slides for this instrument, I found the globe from a deceased Coleman oil lantern. It's the best one I've tried yet. It's just the right width for the strings, and the wide arc of its outside surface makes for noiseless sliding over the wound electric guitar strings. With the hand placed in the middle (instead of holding it from the top), it's easy to control and it's especially easy to tell precisely when the slide is positioned on a harmonic by sensing the vibration from the strings. This instrument features hand-made brass parts where the strings are mounted and a hand-made pickup made with five pickup coils cast in a solid block of epoxy. I had just recently learned to make pickup coils when I made the instrument, and this is the first pickup I've made. It turned out really nice and it sounds just fine. Over all, it took me about two weeks to build the slide guitar.

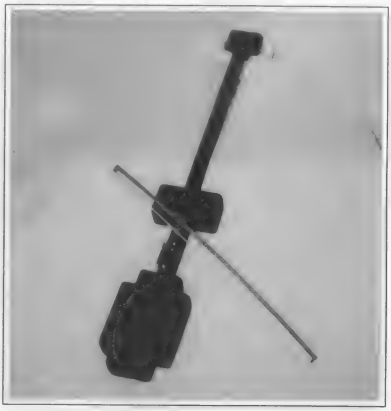
The second instrument, the Two Stringed Electric Viola, is definitely a melodic instrument. I had been wanting an instrument with which I could play simple parts with that violin sound. At my level of proficiency on the violin, I designed this one with two strings to experiment with. I increased the range by making the neck longer than a violin neck, which also stretches out the fingering resolution. It's actually easier to play just intervals on it, again, by sensing the vibration of the string as you finger it. It also helps to have a drone played on another instrument as you play, so you can listen for the interval between the drone tone and the tone you are playing. Since it is an electric instrument, is does sound a bit too "dry" plugged straight into an amplifier, but I have a digital effects unit and putting a little reverb on it makes it sound really nice. It only took me a few days to build this one. It features hand-made brass parts, including a brass fingerboard, two electric pickup coils and extremely rugged oak/epoxy construction. The bow is made with strands of 6 lb. monofilament nylon line slightly roughed with sandpaper. It hasn't required any maintenance yet, other than rosin.

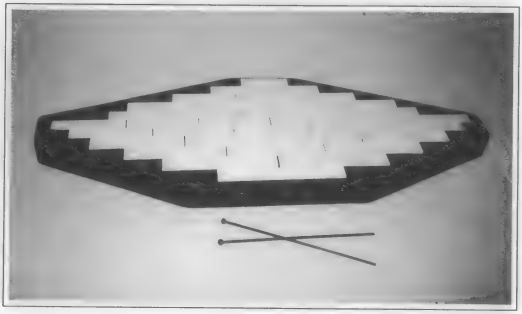
The third instrument, the Electric Diamond Xylophone, has been my biggest project so far. I worked on it for about two months after doing some study, experiments and planning on how to design it. It is tuned to the same set of ratios as Harry Partch's Diamond Marimba. The base is a wood/epoxy construction with 36 pickup coils flush mounted in holes drilled in the top where the center of each bar is placed. A layer of grounded aluminum foil shields the wiring and pickups. Black paint and two coats of clear epoxy resin provide a tough, glossy finish. The bars are made of flat steel. I used a grinder to tune them and a digital synthesizer with the tones programmed into it as a tuning reference. I then gave the bars two coats of white Rustoleum paint for protection. After a final fine tuning to compensate for the weight of the paint and then retouching, I used a stencil and an indelible-ink marking pen to mark the fractional ratios on them. Each bar is supported over the surface of the base by two strips of Velcro at the vibrational nodes. This holds them in place well enough so that they don't move while being struck by the mallets, but allows them to be easily removed for occasional cleaning. I was able to tune the bars very accurately, and they have a nice, clean sound to them. The bars are physically arranged in a diamond-shaped six-by-six matrix pattern. Starting from the lower left to upper right, the rows of bars make six series of harmonics or Otonalities, to use Partch's terminology. The other way, from upper left to lower right, they make six series of subharmonics known as Utonalities. (The "O" and the "U" stand for over and under — Overtones and Undertones.) The matrix pattern is known as a tonality diamond. There is a strategy going on here in the selection of the tones to get the most versatility for the number of tones used. All of the different types of chords can be found somewhere in the matrix in at least one tonality (analogous to "key"), and while using it to accompany other instruments, I can always find at least a few tones to play that fit in with what's going on in the music. Harry Partch was obviously a total genius at this strategic approach to scale selection. I'm very pleased with how this instrument turned out and it's a good way to learn how tonalities of harmonics and subharmonics work together. For more information about this, Harry Partch's *Genesis of a Music* (Da Capo Press, 1979) is an excellent source.

The fourth instrument, the Acoustic Lute, is my latest experiment to date. I was really inspired by hearing the lute-type instruments used by the Jajouka of Morocco, and I went about the design of this instrument with my intuition tuned in that direction.

INSTRUMENTS BY JEFF BUNTING.

Upper left: Electric 12-String Slide Guitar. Upper right: Two-Stringed Electric Viola. Lower right: Electric Diamond Xylophone. Lwer left: Acoustic Lute.





It does sound similar. The whole instrument is a solid oak/epoxy construction. I chose the piece for the neck by sighting it for straightness and checking it with a straight edge to use the best part of the board. A strip of styrene is epoxied to the surface of the fingerboard for a flat, smooth surface. The bridge and the nut are also made of styrene. This lute has four nylon strings. I bought classical guitar nylon strings to start with, but when I change them, I suspect that I'll be able to find fishing line that will work just as well. This instrument only took me a few days to build, and it has turned out to be very versatile; it has a nice sound to it and it's a lot of fun to play.

Last year, I spent a couple of months doing a restoration job on the modules of an Arp 2500 analog synthesizer that resides at the Southeast Just Intonation Center. Denny Genovese built a new cabinet for it and got it going. It makes some really interesting sounds. I've been interested in electronics for a long time and what I've been learning about voltage-controlled synthesizers has been fascinating. There's an elegant simplicity about the way they work. The basic modules that make up a synthesizer are: Oscillators that generate a variety of waveforms as a signal source, filters and amplifiers as signal modifiers and a virtually endless variety of possible controllers to supply the control voltages. Right now I'm studying oscillators until I land on a good design for my first module. I also came across instructions on how to build a Theremin, which will be an interesting thing to try. It is controlled by placing the hands near two antennas that control the pitch and the volume. I've been making good progress with what I've been at lately, and I'll probably have more news on it later on.

Special thanks to Denny Genovese, director of the Southeast Just Intonation Center, for advice and encouragement.

By the time you read this, Jeff Bunting will have completed his first year residency at the Southeast Just Intonation Center. For correspondence, the address for the Center is PO Box 15464, Gainesville, FL 32604.

INSTRUMENTS OF THE CUBAN NATIONAL FOLKLORIC DANCE ENSEMBLE

By Steve Smith

"We study the past not to be detained in it, but to receive knowledge of our roots: to be able to present [our cultural heritage] to the man of today, and especially to the man of tomorrow" explained Cuban ethnomusicologist Rogelio Martinez Fure at a recent performance of the Cuban National Folkloric Dance Ensemble. Featuring 40 dancers, musicians and singers — and a wonderfully diverse arsenal of percussion instruments —their March '96 performance at U.C. Berkeley's Zellerbach Hall was a feast for the eyes and ears.

The program showcased over two centuries of Cuba's rich music and dance heritage. Styles ranged from stately, European-derived ballroom pieces such as the *Danzon,* featuring lyrical flutes and strings, to frenetic rumbas danced to sizzling Afro-Cuban drumming. It was a great opportunity to see and hear many of Cuba's folk instruments played in the most authentic cultural context to be seen this side of the Caribbean.

Before we get to the instruments, a little more information about the company is in order. Founded by Fure in 1962 to preserve Cuba's rich heritage of music and dance, the troupe has toured extensively in Europe, Asia and Africa. Their repertory includes over 70 pieces and represents the diverse cultural influences (primarily Spanish, West and Central African, and — by way of an immigration of coffee-farming aristocrats to Eastern Cuba after the Haitian Revolution of 1803 — French) which have coalesced to produce some of the world's most exuberant and popular rhythms.

Cuban ethnomusicologist Rogelio Martinez
Drawing by Robin Goodfellow

Many of these rhythms owe much of their unique flavor to their particular orchestration of rhythm instruments. Ever present in most percussion pieces were claves (two sticks struck together) and a gourd scraper called a guiro. Metallaphones such as cowbells and a variety of shakers were often added to this fundamental pair, along with that most quintessential Cuban instrument, the conga drum. Also frequently employed were African-inspired call and response singing, and (especially for the more European influenced pieces) harmonic/melodic instruments like flutes, guitars, and violins.

At first glance, the hand held percussion instruments may seem incidental to the music as a whole, supporting the larger and flashier drums. But in Cuban music their role is central.

The term *clave* is used to denote not just the instrument, but the characteristic two-bar syncopated pattern that lies at the heart of virtually all Afro-Cuban rhythms. The phrasing of most other instruments in the ensemble (particularly the drums) revolve around the clave. With one hand cupped to act as a resonating chamber, it is surprising how loud this humble pair of sticks can be. Bright and cutting, the claves are clearly audible even while playing amidst a stage full of drums.

The Afro-Cuban guiro is a scraper made from a tubular shaped gourd cut open on one end, perhaps 12 inches long and four or five inches in diameter. Deep, widely spaced grooves serrate the playing surface, which is scraped with a thin stick. Due to the depth and large size of the grooves, the Cuban guiro produces a relatively deep tone. In addition to imparting texture to the rhythm, the guiro offers the ear a solid downbeat anchor (consistently accenting the first and third beats of each measure) in a rhythmic tapestry often characterized by extreme syncopation and mind-boggling cross rhythms.

With its wide, deep grooves, the Cuban guiro is quite distinct from the scrapers used in neighboring Antilles islands. The Puerto Rican guiro, for instance, is serrated with very fine, shallow grooves, and is played with a "fork" comprised of several round wire tines set in a wooden handle, giving it an entirely different character from its Cuban cousin. Distinct from either of these is the scraper most typically used on Hispaniola. Called a *guira,* it is made of a long serrated metal cylinder open at each end, looking more like a big cheese grater than a musical instrument. Played with a "fork" like its Puerto Rican analog, the guira adds a signature metallic texture to the merengue of the Dominican Republic.

Shakers of several different varieties were also used in the performance. These ranged from the typical maracas made of gourds or calabashes (a round or oval gourd-like fruit that grows on trees native to the Caribbean basin), to more uniquely Cuban shakers called *cha-chas:* metal rattles which were played in pairs by the festively costumed female dancers. The cha-chas were particularly colorful. Made from two small metal cones joined at the wide end and set atop a wooden handle, they featured brightly colored ribbons attached to the pointed ends which waved about as the dancers moved. Like many Cuban instruments, they illustrated the intimate connection between rhythm and dance.

Many of the instruments used in the performance demonstrated the remarkable ability of African-Cubans and their descendants to fashion musical instruments from whatever materials were at hand. In the *Ogun,* a rhythmic ostinato was played on a hoe blade struck by a piece of metal, an "instrument" to be found on any of the sugar plantations which covered the island nation by the turn of the century. It had a surprisingly lovely sound rich in sustain and high-pitched overtones.

Another wonderful example of this ability occurred in the program's first piece, *Guajiras* (Country dances), which featured two drums made by stretching cowhides over the frames of ordinary wooden chairs (picture a chair with a rattan seat, the cowhide being nailed on in place of the rattan). With the chair backs leaning away from the drummers to tilt up the playing surface, they were played with bare hands in similar fashion to a conga drum. Perhaps owing to their square shape, they produced a thumpy sound much drier than a conga and having less sustain than a typical round frame drum.

Both the *Guajiras* and the *Sones* (the predecessor of modern Salsa rhythms and song structures) featured one of the Caribbean's most interesting instruments: the *marimbula.* A lamellaphone that is in essence a giant African "thumb piano," the marimbula performs the musical function that would be handled by a bass guitar in a modern Latin music group. The Cuban dance ensemble's marimbula consists of a roughly square wooden box which the player sits upon. On its front face five or six metal tines about an inch wide and ranging from about eight inches to three inches in length are clamped between two pieces of wood which form a bridge. A sound hole positioned below the tines allows the resonance produced by the instrument to be dispersed. Played with the index and second fingers, the marimbula's warm, boomy sound lends a solid bottom to the traditional Son rhythm section of claves, bongos, maracas, guitar and *tres,* a smallish Cuban guitar-like instrument with three pairs of strings.

The Cuban National Folkloric Dance Ensemble
Photo by José A. Figueroa

Many Cuban dance and music styles originated in African religious contexts. In the nineteenth century, tens of thousands of slaves were brought to Cuba from West and Central Africa to work the labor-intensive sugar plantations. The majority of these were Yoruba peoples from present day Nigeria.

In Cuba, the descendants of these people came to be known as Lucumi, and they remain an identifiable sub-culture even today. Many of their African cultural and religious beliefs became distilled in the Cuban religion called Santeria. Thus many of the deities of Yoruban civilization (called Orishas) continued to be worshipped by the Cuban slaves and their descendants.

The Cuban National Folkloric Dance Ensemble has preserved many of the religious dances and rhythms associated with these deities. Dances such as *Ogun,* performed in honor of the Santeria god of war and metal by machete-wielding men in grass skirts, and the *Yemaya* — danced by women to honor the Santeria goddess of the sea — were highlights of the performance. These pieces featured a trio of bata drummers.

The bata drums (which are believed to be of Yoruban origin) were considered sacred by the Lucumi and were not used for secular purposes until this century. They are hourglass-shaped cylinders traditionally headed with goat skin on either end, and are played horizontally across a player's lap. Each end of the bata drum is of a different size, producing a higher and lower pitch. As each drum in the traditional trio is of a different size, together they produce six distinct pitches, not to mention the various articulations executed by the players' hands: open tones, closed tones, slaps and the like.

The largest bata is the master drum, and is strung with a necklace of bells called *chaworo.* These are sounded by the master drummer by shaking the drum on his knee as it is played. The effect these complex rhythms produce is truly mesmerizing. Against this rhythmic backdrop, the *Yemaya* dancers, gracefully spinning in gorgeous multi-layered blue skirts, seemed indeed a human incarnation of the dramatic Caribbean sea.

Several dances presented by the ensemble were secular in nature. These included the *Guaguanco,* a sensual rumba which horrified genteel audiences around the turn of the century with its blatant sexual energy and frenzied conga drumming. Such styles had a great influence on the *cha-cha-chas* and *mambos* which went on to become the world's most popular dance crazes of the 1940s and 50s.

The ensemble concluded their performance with an animated rendition of Cuban Carnival music, complete with wildly costumed dancers cavorting to its driving beat. Quite distinct from other Cuban genres, the Cuban carnival ensemble (or *Comparsa)* consists of a seemingly ad-hoc assortment of bass drums, metallaphones, snares, congas, woodwinds and brass. It also features another wonderful home-spun instrument called *sartenes,* a set of two frying pans bolted upside down to a board, the whole contraption being suspended by a rope around the player's neck. Lightening fast, two-pitched ostinatos are created by striking the pans with wooden or metal sticks. They were played in counterpoint to two other humble metallaphones: an agogo-style iron dance gong and (my personal favorite) a salvaged automobile brake drum struck with a piece of scrap iron.

The ensemble invited the audience to dance on stage with them during this piece. Several hundred did! It proved an exhilarating finale to their enchanting performance.

Steve Smith is a writer and musician based in Sacramento, California.

RAMBLINGS

by Bart Hopkin

Today's topic: Alternative forms for electric pickups on string instruments.

Many stringed instruments are rather quiet, and call for amplification at least some of the time. To amplify the sound electronically, you need some form of transducer. The transducer is whatever converts the instrument's sound-producing vibratory motion into an analogous electrical signal which can be sent to an amplifier and loudspeaker. Three types of transducer are commonly used: air microphones (the familiar dynamic mics and condenser mics), electromagnetic pickups (the sort used in electric guitars), and piezo-electric pickups (contact mics). Each of these transducer types has its advantages and disadvantages.

I have occasionally speculated as to whether there might be other methods of transduction that could be useful in overcoming some of the disadvantages of the standard methods. These alternative methods are for the most part untested (by me, anyway), and I'm aware that they're impractical in a lot of ways. I'm putting them forward now, just to give people something to think about next time they're struggling with feedback problems or despicable tone quality from their existing mics or pickups. I sent an early draft of this article to Donald Hall, a Professor of Physics at Sacramento State University and a frequent and generous advisor for *EMI* on topics such as this. His comments are interspersed through the article.

Proposed Alternative Transduction Method Number 1: Radar.

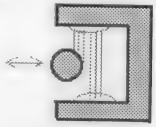
Since World War II we humans have had access to radar technology almost as good as bats, and improvements are being made all the time. Would it be possible to attach a little radar or sonar device under an instrument's strings to track their motion? The system could be based upon reflected radio waves or light, or perhaps ultra-sound. It might also be possible to set up this approach to respond to the motion of the sound board rather than the strings. With several sensors trained on selected points on the soundboard, you could obtain a broadly representative picture of soundboard motion.

In response to this idea, Professor Hall notes "Certainly the principle is valid, while in practice it may be hard to make this competitive." One difficulty he notes is that the thinness of the strings puts them at a disadvantage as a reflecting surface. A greater difficulty, for the strings and particularly for the soundboard, is the small amplitude of vibration. If the range of motion of the vibrating body is not at least as great as several wavelengths of the radar signal, tracking is difficult. "A scheme using visible light (or infrared), so that even small vibration amplitudes are many wavelengths, is to make the target (say guitar body) a mirror in an interferometer; but that tends to get quite complicated."

Proposed Alternative Transduction Method Number 2: Interrupted Light.

With a light source on one side of the strings and a set of tiny photoelectric sensors on the other, it might be possible generate the desired alternating voltage corresponding to the string's motion. The voltage would be generated as the string's vibratory motion causes it to periodically interrupt the light beam falling on the sensor. Alternatively, perhaps the sensor and the light source could be located on the same side of the string, with reflected light from the string activating the sensor. The challenge would be to get the geometery just right between the three elements (light, string, sensor). A potential difficulty is the fact that instrumentalists don't always pluck strings the same way, and as a result plucked strings don't always vibrate in the same plane of movement, potentially throwing off this geometry.

Professor Hall notes that devices like this do exist. "There's a commercial device called an optoelectronic detector whose original purpose was mainly to serve as an on/off device to tell whether a light beam was interrupted or not, e.g., closed/open status of a door. It looks something like this:



"A small infrared LED sends a beam across the space between the legs of a molded plastic U-shaped device (maybe about a cm or so across) to a detector. Instead of a small vane mounted on a door to interrupt the beam, let a string be carefully positioned so that it blocks only about half the beam. Then when the string vibrates, fluctuations in the voltage output from the detector nicely mirror its position." Following the suggestion of his colleague Anders Askenfelt, Professor Hall has used this device in piano string reasearch and in classroon demonstrations of violin string motion (for the classroom demonstration, the output was sent to an oscilloscope). "It would take a pair of such sensors, mounted at right angles to each other," he notes, "to detect string motion in both planes."

Proposed Alternative Transduction Method Number 3: Iron Strings.

One of the reasons electric guitars sound as they do, and have the playing-feel that they do, is that they're virtually always strung with strings of spring-tempered steel music wire — the strongest and brightest-sounding stringing material around. If you want the softer feel and sound of nylon or other stringing materials, you can't get it with an electromagnetic pickup because, as mentioned above, those other materials don't have the requisite magnetic quality. It should be possible, however, to manufacture strings with the required iron content for magnetic response, yet which have more of the soft feel and sound. Specifically, strings of unalloyed iron, such as were used on many early harpsichords, might fill the bill nicely. By using strings of iron, and perhaps other selected iron alloys as well, one could combine the convenience of an electric guitar pickup with some of the sound and feel of non-electric instruments using softer stringing materials.

Proposed Alternative Transduction Method Number 4: Electromagnetic Soundboard Pickup.

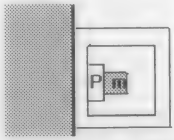
Electro-magnetic pickups, such as those used on electric guitars, work only with steel strings They won't work with strings made of nylon, gut, silk, bronze, or dental floss, because non-ferrous materials don't generate the magnetic response that the pickup requires. Why not, then, suspend the pickup over the soundboard? Well, that's obviously a silly suggestion, because the soundboard is made of wood — another non-magnetic material. OK, then, let's mount a bit of steel on a vibrationally active part of the soundboard, and suspend the pickup over that. The ideal approach, in fact, would be to run a fine ribbon of steel (neither heavy nor rigid) across the face of the soundboard, and use a rather wide pickup over it ... or several smaller pickups. This would ensure a more balanced response (though less efficient) than one which tracks only the motion of a single point on the board.

Of the ideas discussed in this article, this is the only one I've actually tried. It worked, and I was actually able to amplify a nylon-string guitar with an electric guitar pickup. But my arrangement, hastily assembled, was pretty crude, and the resulting signal was weak and noisy. Maybe some day I'll take the time to do a better job of it.

Professor Hall comments: "Yes, that's a reasonable way to detect velocity. In fact, the idea of adding a little ribbon or patch of magnetic material corresponds well to a standard technique for velocity sensors in the laboratory: along with the magnetic sensor (involvoing an iron-core coil through which induced voltages will appear) are provided a supply of tiny mu-metal discs which can be glued onto any vibrating body made of non-magnetic material, the disc being located at the spot intended to be just across the air gap from the detector."

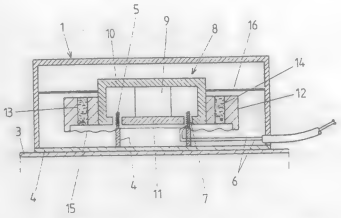
Professor Hall adds the following to the list of possibilities:

"Accelerometer: For the sake of completeness, this is a standard type of motion detector in lab or industrial application. Being sensitive to acceleration rather than velocity or displacement means being relatively more sensative to higher frequency vibrations than the other types. The traditional kind of accelerometers have a small piezo crystal P which is the only connection to the outside world for a 'floating mass' m [see the illustration]. When the body vibrates and carries the whole device along with it, P has to provide the force to cause m to accelerate and keep up, so the stress F=ma [force = mass times accelleration] on the crystal causes proportionate voltage."



In addition to the traditional accelerometer design, Professor Hall points out a recent patent for a device operating on similar principles, but using an electromagnetic arrangement rather than piezo-electric. Stephan Schertler's U.S. patent # 5,461,193, "Sound pick-up for Resonant Bodies" (mentioned in the patents round-up in the May 1996 issue of the Journal of the Acoustical Society of America). For those interested enough to read the tiny numbers, I will reproduce one of the patent drawings here and quote from JASA's synopsis:

The pickup of this patent has a housing 1 which can be cemented or otherwise secured to the resonant wall 3 of a musical instrument (e.g. guitar) having resonant cavities. Wall 4 of the pickup housing supports a moving coil 5 within an annular gap 7 of a magnet structure 9 supported from the pickup housing on a plate-shaped spring 16 which is very stiff in its own plane but compliant in the axial direction perpendicular to its own plane. Vibration of the musical instrument wall 3 is tranmitted to the coil 5, causing it to vibrate within the air gap of the magnet structure, thus transmitting an output signal through conductor 6 corresponding to the wall vibration.



...And , finally, a Proposed Alternative Approach to Amplification: Feeding Back to the Soundboard.

This idea is not for a transduction method, but rather an approach to the overall amplification process. I originally had the idea some time ago, and had since forgotten about it, but I was reminded of it recently when I saw a newspaper article about some acoustics people at Georgia Tech working in a related area. (The Georgia Tech work is quite a bit subtler than what I'll describe here ... see "Recent Articles" on the back cover of *EMI*'s September issue for a precis.) The idea is to take an electric signal from a stringed instrument by one or another of the standard transduction methods, send the signal to an amplifier, and then, instead of sending it to a speaker, send it back to the soundboard. This would involve setting up something like a speaker magnet somewhere over or under the soundboard, fixing a piece of iron to the soundboard to make it magnetically responsive, and letting the amplified signal drive the soundboard just as it would a speaker. The amplified electric signal would thus reinforce the input from the strings, making the overall sound louder. Admittedly, there are some serious potential difficulties here. They have to do with such matters as phase relationships, how an overdriven soundboard would behave, and the amount of power required to drive a board that is much heavier and more rigid than a typical speaker cone. Depending on the transduction method, there are also potential feedback problems. On the plus side, the result, hopefully, would be an enlarged, natural, woody, acoustic sound. The sound would not be displaced in space as it is with a separate speaker cabinet, and there would be some convenience in doing away with the cabinet. It might be possible to electronically fine-tune the input in various ways to achieve either an enriched natural sound or some interesting unexpected artificial result.

As I mentioned earlier, I've actually tried only one of the ideas described here, and that one rather crudely. The main reason I haven't experimented further is, I don't have the technical know-how to do it — in particular, I haven't studied radar or ultrasound techniques, and I don't have access to the required equipment. Maybe one of these days I'll find a way and make the time to pursue these things ... or maybe someone reading this will get to it before me.

RECORDINGS REVIEWS

By Warren Burt, Mitchell Clark and René van Peer

CAJSA S. LUND: FORNNORDISKA KLANGER — THE SOUNDS OF PREHISTORIC SCANDINAVIA

Musica Sveciae MSCD 101 (1984; CD reissue, 1991). Notes in Swedish and English.

The Sounds of Prehistoric Scandinavia is a sonic catalogue of the sound-makers and musical instruments of an extensive period from remote Scandinavian pre-history through the first millennium AD. Originally released as an LP in 1984, this collection is a carefully researched work by Swedish music-archaeologist Cajsa S. Lund, who has had close contact with the archaeological materials which form the basis of this project. Lund uses direct reconstructions of actual original artifacts found in Scandinavia, although in a few cases, such as the Bronze-Age *lur*, the actual instrument is heard.

The album is in three sections, listed as *Stone Age* (*ca.* 10,000-1800 BC; tracks 1-13), *Bronze Age* (*ca.* 1800-500 BC; tracks 14-23), and *Iron Age* (*ca.* 500 BC-AD 1050; tracks 24-41). The 41 selections are each short and most of them are subdivided, with the subdivisions seldom taking more than a half a minute. Most of the selections are in the nature of demonstrations, often showing the sound-maker or instrument in two or three sounding contexts — hence the subdivisions. Some examples of the contents are: a bone scraper, mouth bow, bull-roarers, and the "Falköping flute" (*Stone Age);* bronze rattles, a singing-stone, the "Balkåkra gong," and bronze lurs (*Bronze Age);* and pellet bells, a lyre, pan-pipes, and a bagpipe (*Iron Age*). As is the nature of musical-archaeological investigations, what has survived to be sounded are the "hard parts" of the total picture of prehistoric sound and music making — the "soft parts," such as instruments made of vegetable materials, as well as the human voice, have weathered away.

In her work, Cajsa Lund has investigated the questions of what would have been the sonic environments of prehistoric cultural communities, and has based theories and reconstructions on such investigations. One of her articles, "On animal calls in ancient Scandinavia" (in Hickmann and Hughes, eds., *The Archaeology of Early Music Cultures;* Bonn, 1988), addresses such issues pertaining to three bone artifacts, which may have been "blockless duct flutes," dating back to Neolithic times. She points out how such artifacts may have been used by hunters as animal decoy-calls. One of the artifacts she covers in "On animal calls in ancient Scandinavia" can be heard on *The Sounds of Prehistoric Scandinavia.* This is the "button flute" found in Västergötland, Sweden, and dated to *ca.* 2300-1800 BC. On track 12, it is heard demonstrating bird decoy-calls, with the sounds of black grouse in the background. As we learn that the black grouse is presently not found in that area of Sweden, but is thought by archaeologists to have been there during Neolithic times, we can get a feeling for some of the archaeological detail which Cajsa Lund brings to *The Sounds of Prehistoric Scandinavia.*

As a catalogue of sounds made by primitive sound-makers and early musical instruments, *The Sounds of Prehistoric Scandinavia* is a very useful reference. It is quite polished in its archaeological discipline, but not always so in its musicality. In addition, most of the selections on *The Sounds of Prehistoric Scandinavia* fade out at the end, a procedure which detracts from any quality of realistic presence to the selection as a whole. Some of the sounds of these instruments are unfamiliar and we'd like to hear more, but they are whisked away before a listener can focus on them. For example, in the second track, of a bone scraper, seagulls and seals may be heard in the background. Any evocative quality the soundscape as a whole may have is wrapped up and put away, however, when the sounds receive a recording-studio fade out.

However, there are some strong musical selections on *The Sounds of Prehistoric Scandinavia.* One is the hypothetical reconstruction of a musical ensemble of two bronze lurs, the Balkåkra gong, and a clay drum, based on an early Bronze Age rock carving from a tomb in Skåne, Sweden (track 23). Another is the vigorous "Strumming" portion of the track (30) of a reconstruction of a Viking-Age lyre, made and played by Graeme Lawson. The usefulness of the album is augmented by the information in the album's illustrated booklet, and still further by the fact that detailed information about these archaeological materials is available in the publications by Ms. Lund.

I'd like to make reference to another album, related to *The Sounds of Prehistoric Scandinavia* in its attempts to reconstruct music of pre-history: The Art of Primitive Sound's *Musical Instruments from Prehistory* (Hic Sunt Leones [Italy] HSL 003; c. 1991). This album has been reviewed before in *EMI* (by René van Peer in Vol. 9, #1), so I'll mention it here as a comparison to *The Sounds of Prehistoric Scandinavia.* Beginning with the credits in its liner notes, it is made clear that *Musical Instruments from Prehistory* is a collection of newly composed works using primitive instruments, proceeding from archaeological evidence as well as from an intuitive sense. The results are usually musically very engaging where, on the level of musicality, *The Sounds of Prehistoric Scandinavia* unfortunately often can't shake its quality of being a demonstration record. All of the sound-makers and instruments on *Musical Instruments from Prehistory* are primitive, comparable to those in the *Stone Age and Bronze Age* sections of *The Sounds of Prehistoric Scandinavia.* In *Musical Instruments from Prehistory* the combinations of sonic colors are sensitively considered, and many of the pieces have an attractive musical (proto-musical?) logic to them which contributes to their evocativeness and their sense of authenticity. Even selections which are more in the nature of a demonstration (such as track 4, of four different "flying rhombs" — bull-roarers), are elegantly done. Clearly, Walter Maioli of the Art of Primitive Sound has taken an approach of creatively exploring the sonic and musical implications of the archaeological record, and of the natural materials available for primitive sound-makers (see, for instance, his impressive, detailedly illustrated study *Klank en muziek* {Dutch edition, Atrium, 1993}).

— MC

THE MCLEAN MIX: GODS, DEMONS, AND THE EARTH

CD, Capstone CP-8622, available from the Electronic Music Foundation; phone 1 (518) 434-4110; e-mail emus@emf.org or emusf@aol.com.

This is the latest collection of pieces available from Barton and Priscilla McLean, composers, performers, and ecological activists. Instruments used include the Burgess Shale Xylophone (pre-Cambrian rocks with a beautiful clear bell-like sound), the inherently microtonal clariflute (a clarinet mouthpiece on a recorder body), percussion, a full range of digital synthesizers and processors, samples of a wide range of

animal and human sounds, and Priscilla's virtuosic voice.

As in their previous album, *Rainforest Images*, the music is romantic in conception, orchestral in texture, and contemporary in its sound world. Thick textures of orchestral samples, animal sounds, and electronic timbres are mixed and manipulated with a very clear sense of narrative, and a dramatic, gestural sense clearly related to the symphonic tradition.

Bart McLean's "Earth Music" opens the disk with the processed pure ringing tones of the Burgess Shale Xylophone accompanied by a wailing melody on the clariflute. This leads into the body of the piece, a setting of an ecological text by Cedric Wright performed by Priscilla. The very literal text setting is extremely well integrated with the other sounds of the music. Basically, this piece is a contemporary, and very satisfying, version of an orchestral song setting.

Three movements from Bart's "Visions of a Summer Night" follow. The first, "Demons of the Night" has to be the best expressive "demon music" since Mussorgsky's "Night on Bald Mountain." "Valley of Lost Dreams," with its nostalgic and sweet use of sampled children's voices and songs, is an Ivesian fantasy on past events in Hill Hollow valley in northern New York State, where the McLeans formerly lived. "Fireflies" is a very delicate electronic and sampled sound piece accompanied in live performance with light patterns from the Sparkling Light Console, a light instrument built by Bart. As a sound-only piece, it still works beautifully.

Two major works by Priscilla round out the disc. The first, "Wilderness" is, like Bart's "Earth Music," an extended ecological text setting, this time of a poem by Carl Sandburg. The piece opens with a wolf howl. This is no hazy impressionist evocation of "nature." Here riveting animal cries, shrieks and screams, Priscilla's virtuosic voice, which plays wildly with the symbolism of different kinds of vocal sounds (now operatic, now childlike, now ululating, now noisy), and a wide variety of electronic sounds paint a picture of "nature red in tooth and claw," a nature that, in Sandburg's words, lives inside each of us. "Dance of Shiva," also by Priscilla, is my favorite piece on the album. Like "Fireflies," this piece was also originally accompanied by visuals, and again like "Fireflies," it stands quite successfully on its own. It's probably the most "abstract" piece on the album, in spite of its successful integration of samples of Tibetan Buddhist and Christian medieval singing into its often complex, polyrhythmic texture of instrumental, vocal, insect and electronic sounds. These sampled chants provide moments of " reality," but they don't really make the piece "narrative" in the way the Sandburg and Wright texts do.

Throughout the album, the quality of the sound used is outstanding, many of the sounds and mixes having absolutely luscious timbres. All together, a very satisfying album.

—WB

VINCENZO P. MENANNO: **WAVES IN MOTION**

On cassette from Waves in Motion, 5789 Monk Blvd., Montreal, Quebec H4E 3H2, Canada

With the development of computational possibilities and applications the time has arrived that sequences of pitches, chords and timbres can be generated automatically. Brian Eno has his Generative Music — smooth, extended sounds that give the listener a feeling of cool snugness. The Hub operates at the other end of the spectrum; they wouldn't mind their programs to wander off into the unforeseen, to run beyond control. Vincenzo P. Menanno sits clearly on the Eno end of computer generated music. His Waves in Motion is a set of algorithms that enable him to extract sonic events from his circuits that are different every time around. "Thus," he writes in the notes to the cassette, "each tape recorded is a unique performance, and every tape has its own unique serial number: No two will ever be the same."

Menanno's achievement lies in the fact that he managed to write the software to fit his intentions. How much of an achievement that actually is, I can't judge. It seems to work perfectly, effortlessly. The tape sounds as if neither the machinery nor the program ran into obstacles. Not very surprisingly Menanno subtitles the tape "Relaxation Algorithms." His expectation that these compositions enable the listener "to tune into his/her own innate universality," is a truth if ever there was one, as far as I am concerned — listening to the tape made me aware, once again, that the key to feeling relaxed is a minimum of input; albeit that in my case this amounts to silence.

—RvP

PANDIT KAMALESH MAITRA: **TABLA TARANG — MELODY ON DRUMS**

On CD from Smithsonian/Folkways. SF CD 40436

The tabla tarang consists of a variable number of the North Indian tunable drums, called tabla, ranging between ten and sixteen pieces. They can be tuned to the tone scales of Indian ragas. Placed in a semi-circle, the instrument allows the musician to play melodies in a way that reminds one of the marimba. The timbre is rather soft and round, but deep and resonant at the same time. The more power the player brings to the instrument, the clearer one can hear the slap of the fingers on the drum heads.

The instrument was developed in the last part of the 19th century and has always been mainly used to accompany dance performances. Pandit Kamalesh Maitra, the virtuoso soloist on this CD, is currently the sole person playing the tabla tarang; he is also the only player to use it as a full-blown concert instrument. It is very likely that when he dies, this art will die with him.

One interesting aspect of Maitra's music lies in the way it differs from ragas played on more common instruments, such as the sitar and the sarangi. On these latter pitch bending and glissandi are an integral part of how the melodies are shaped; rhythm is of secondary importance. Pitches on the tabla tarang are constant, the rhythm is well defined; the resonance, however, sometimes makes subsequent tones blend together.

With his impeccable technique Maitra matches the swiftness of colleague raga masters. His music is most effective when he is accompanied by the more regular tabla set, played by Trilok Gurtu. Together the musicians develop duets in which Maitra seems to phase in and out of his companion's rhythm patterns. Gurtu makes his drums sing a restrained counter-melody to the lines that Maitra rolls out. And yet, in spite of the virtuoso speed displayed by this man, his music is somehow strangely dispassionate.

The CD comes with an extensive and informative booklet. In it you can find six beautiful drawings of various stages of the construction of a tabla drum.

—RvP

PAUL PANHUYSEN: **THE GALVANO'S**

On 7" vinyl disc from Table of the Elements, PO Box 423838, San Francisco, CA 94142

The Dutch artist Paul Panhuysen has developed an ingenious sound processing setup as an extension of his long string installations. This setup links string instruments to a stereo set through galvanometers and long strings. The meters are connected to the line-out channels of an amplifier, receiving the signal that would otherwise have gone to the speakers. The electric currents, that vary according to the sounds on the recording being played, are registered by the devices and translated into minute vibrations that set the pointers in motion. On each device one end of a long string has been fastened to the base of the pointer, the other end is attached to the strings of an electric guitar, a cello or any other such instrument. Recently Panhuysen used a piano as the far end of the setup. For *The Galvano's* he used eight electric guitars and played some of his own previously made, CDs to drive them.

The result is a strange woolly and yet metallic drone, full of sounds and tones that remain within the sonic haze. It calls to mind the way thunderclouds can bulge and hover, changing all the time and looking as if they can barely contain what forces are hiding within them. At irregular intervals one of the strings lashes out at the guitar it is connected to, striking out chords that seem to flash from the drone like lightning. The

ominous music emanating from this installation contrasts beautifully with its name. *The Galvano's* is what a band playing at weddings could typically call itself. Makes one want to know if some soon-to-be-married couple ever tried to hire this ensemble; if it ever was presented to an expectant crowd ready to whirl a waltz.

— RvP

HARRY PARTCH: **ENCLOSURE 2**

On CD from Innova Recordings, 332 Minnesota Street #E-145, Saint Paul, MN 55101-1300

I ended a review of recordings with music by Harry Partch (published in *EMI* Vol VIII, #3) expressing the hope that discontinued albums with his compositions would be re-issued on CD. Innova Recordings has gone beyond expectations and wishes — this Minnesota based label published a video, a four disc CD set and a compendious scrapbook. Called *Enclosure 1, 2 and 3,* these are documents of unpublished and hard-to-get traces left by this innovator, who carved out such a unique musical career for himself: devisor of a just intonation tuning system, instrument builder and composer.

The CD set is a motley compilation of early compositions, and excerpts from talks and interviews, ending with a 45 minute audio document compiled from a privately taped conversation with Danlee Mitchell (probably Partch's closest associate for years) and his wife, and a memorial meeting of friends of the composer a few weeks after his death. Of all the music included, this album is currently the only publicly accessible source. The spoken text puts the compositions in a unique perspective.

Not only do you hear Partch himself venting his opinions on his own work and on compositional practice from the Romantic era to his own days, you also hear clearly how much Partch was in tune with his philosophy when he talked. He doesn't just speak, he intones his words with his melodious voice — as if aware that anything he said could be set to music in his tuning system. What he says indicates that he could be as ribald and sublime, as flippant and serious, as the music he created. In most of the compositions Partch is musician and vocalist.

The first three discs of this set are a real treasure, enjoyable for the music and the composer's introductions to it. The recordings of the conversations on the last disc are maybe prize material for hard core Partch adepts and academics who wish to dig into the private life of a composer to gain more comprehensive knowledge of his or her body of work. Listening to these conversations gave me the uncomfortable and embarrassed feeling of snooping into a person's affairs that are none of my business.

On the other hand I admired Warren Burt's spirited rendition of *Bitter Music*, Partch's hobo diary from the '30s that he didn't publish and in course of time withdrew from his list of works. One whole disc being devoted to it, this performance is an astonishing feat — 73 minutes of demanding text and singsong, accompanied on the piano by Sheila Guymer, recorded live and convincing throughout.

—RvP

KENNETH TURKINGTON:
THE AEOLIAN HARP OF HENRY DAVID THOREAU

Walden Winds [no number], 1994, cassette; available from Walden Winds, 35 Russell Hill, Brookline, NH 03033

Perhaps the only released recording dedicated to the sounds of a single Aeolian harp, *The Aeolian Harp of Henry David Thoreau* contains a recorded hour with a reconstruction of the Aeolian harp which had been owned by the Concord Transcendentalist writer and poet, Henry David Thoreau. Thoreau's three-stringed instrument has been reconstructed by Ken Turkington of Brookline, New Hampshire, and this reconstruction is featured on this recording. The Aeolian harp is given its "classic" unison tuning for the entirety of side one ("Unison Tuning") of the cassette. On side two ("Dissonant Variations"), Turkington experiments with non-unison tunings, in which one string is tuned at the various intervals of a fifth, a minor second, a third, and so on, above or below the other two strings (which are in unison with each other). The Aeolian harp recordings are made in Brookline, and, courtesy of Droll Yankee, a New England outfit which specializes in recordings sounds of bygone eras and of nature, the sounds of a steam locomotive opens the album, and birdsong is added to the majority of the tracks to enhance their naturalistic feel.

As a recording of an Aeolian harp, *The Aeolian Harp of Henry David Thoreau* is perhaps the best I've heard. With a single Aeolian harp, the effect is far more direct — while capturing the subtlety of the instrument — than in a work constructed from a variety of recordings, such as Roger Winfield's *Windsongs: The Sound of Aeolian Harps* (Saydisc Records CD/SDL 394; see review in *EMI* Vol. 10 #3). The occurrence of a thunderstorm during the recording which goes into the "Unison Tuning" side is quite astounding. The palpitations of the moving air can be heard rhythmically driving the thunderstorm's rain and then mirrored in the throbbing sounds of the Aeolian harp itself. On the "Dissonant Variations" side, the change from one tuning to another is marked by brief sounds on windchimes, which is a very effective way to mark the transitions.

The overlay of the bird and train sounds is, to this listener, a less effective feature of the album. The birdsong ends up being more static over the course of the period of the album's one-hour running time than I believe it actually would during an hour of rural, or semi-rural, New England time, especially with a thunderstorm passing through. Alternatively, if we want to view the album as a collage of pieces of New England time, then I think the birdsong variety would be even greater. (And what sorts of counterpoints would take place between an Aeolian harp and cicadas, or crickets, or spring peepers?)

But Thoreau's Aeolian harp is the focus of this album, and it sounds wonderful. This release is a very welcome addition to the available recordings of Aeolian harps, and is of central importance among them.

—MC

PETER WHITEHEAD:
GISELLE (MUSIC FOR HOMEMADE INSTRUMENTS)

On cassette from Peter Whitehead, 455A Valencia St., San Francisco, CA 94103

This piece by Peter Whitehead is one of the pleasant surprises one may come across as a reviewer of this magazine. The cassette to *EMI*'s Volume VII featured pieces he played on some of his instruments, giving an impression of their delicate sounds. *Giselle* is a full length composition, conceived and executed as the music to a ballet which was performed at Footworks in San Francisco two years ago. On this tape you can hear a considerable array of instruments, most of them built by Whitehead himself and all played by him.

Recordings such as this are quite valuable in that they make clear how evocative instruments can be that don't belong to the Western tradition. The timbres of conventional instruments tend to be restrained, whereas those used in *Giselle* sound as if charged with strong emotions. Each has its own very distinct timbral character. Whitehead uses those qualities quite effectively, for instance, in a piece where he contrasts drones and excited sinuous lines played on nasal horns with light and dry drums that beat gradually accelerating rhythms. In another track he has a *kemanje* (a spike fiddle) play a modestly plaintive melody against the velvety backdrop of a darkly humming cello lightened by delicate bell-like tones.

Obviously Whitehead has a keen ear for sounds, a feeling for combinations of unusual instruments and for melodies that suit various sets of them. He is also one of those people working in this field, who play the entire collection of instruments he made. Giselle being one of the hallmarks of Romantic ballet originally, Whitehead's music makes me wonder what this modern version looked like.

—RvP

NOTICES

UNUSUAL MUSICAL INSTRUMENTS WANTED especially mouthblown. Dr. Guy Grant, Bigfoot Music, 127 Sorell St., Devonport, Tasmania 7310, Australia. Ph/fax Australia 61 (3) 64 24 4957; guygrant@tassie.net.au [12-2]

T.V.F., a video production company, makes videos of performance, happenings, events, installations, intermedia art, dance, theater, the borderline between music & sound & visual art. In the "Other Sounds" section of the T.V.F. catalog can be found documentation of works by Hugh Davies, George Maciunas, Moneik Darge & Willem-Godfried Raes, Hans van Koolwijk, Max Eastley, Stephan von Huene, Joe Jones, and many more. T.V.F. distributes only to educational institutions, festivals, museums, and artist-run organizations. For information contact T.V.F. at Viktoriagade 7 DK-1655 København V, Denmark; Ph/fax (...45) 31 24 59 87. [12-2]

ANONYMOUS FAMILY REUNION. I ("anonymous") think of everyone who's ever chosen to be "anonymous" as being part of the same "family." Whether people have been "anonymous" because of sex role oppression, possibility of criminal prosecution, rejection of egoism, mysteriousness, obscurity, sense of humor, or whatever, we have our "anonymity" in common — & I think it's time we met. Therefore, I propose a "Family Reunion" for the summer of 1997 to be at a location & time collectively decided on. Special accomodations can be made for those desiring secrecy. Please contact "anonymous" at 3809 Melwood Ave, Pittsburgh, PA, 15213, USA. [12-2]

The SPIRITFLUTE (patent pending) is a new motion-activated instrument. It is not blown, but held at one end and swung gently through the air. A flute-like tone immediately sounds, making melodic leaps in response to subtle variations in motion. Rhythmic movement creates rhythmic phrases. Rapid arpeggiations and trills are as easily played as sustained tones. Fingering the tonehole causes the SpiritFlute to alternate between two sets of harmonic overtones which are established in a predetermined musical mode. As such, it cannot play "wrong" notes.The SpiritFlute is available in the key of *Ab* in three different modes — Major, 'Blues', and Mid-Eastern — for $42 ppd. each. Playing range is Ab4 to Ab6 (2:1 - 8:1). Please send enquiries and orders (specify mode) to: Michael Meadows, 2226 W. Barker, West Peoria, IL 61604. [12-1]

FAULTY PALINDROME: See if you can find what's wrong with this palindrome that I made up. If you can find a way to fix it (as I could not), I congratulate you! The events described take place backstage during preparations for the *Three Crooners* concert, featuring Tony Bennet, Don Ho and Eddie Kantor. The palindrome:
"Oy! Not — eek! — me, oh no," demanded Ed. "Name Don Ho emcee, Tony-O!"

KENTUCKY KALIMBA FOR TWO — unique design, pentatonic scales on both sides for two players simultaneously! Hand-crafted walnut, 8 spring-steel keys, tuning marks for easy alignment. $50, $60 with gourd resonator. From Gregory Acker, 518 E. Kentucky St., Louisville, KY 40203 (502) 585-5134. [12-1]

THE WORMHOLE ... One of a kind, diamond in the rough? store in WPB, FL, seeks unusual musical instruments for consignment purposes. Please write ... or call ... Steve Rullman c/o Wormhole, 115 So. Olive Ave., WPB, FL 33401; phone (407) 659-3082. [12-1]

Sing, My Khomus: Jew's Harp of the Sakha (Yakut) People, Eastern Siberia has newly been released on CD by Nihon Koukin Kyoukai (Japan Jew's Harp Association). The texts are in Japanese, Russian and English. The cost for purchase outside of Japan is US $30 including shipping. Payable only with international postal money order; bank checks not acceptable. Send to Leo Tadagawa, Nihon Koukin Kyoukai, 1-12-24 Midorigaoka, Ageo, Saitama 362, Japan; e-mail fm9r-tdgw@j.asahi-net.or.jp. [12-1]

UK company Longwave Instruments are looking for a distribution outlet in the US for high quality hand-built theremins, and the MCV1a Theremin MIDI/CV interface. E-mail 101364.522@compuserve.com; tel: +44 1747 820 536, ask for Adam. [12-1]

By Geary Thompson:
The Quartal System (introduction, using comparison graphics): $5.00 pp
The Quartal Concept (explanation of evolution and conception): $5.00 pp
The Quartal Guitar (chord and scale fingering reference): $10.00 pp
The Quartal Board (chord and scale fingering reference): $10.00 pp
Quartal, 6462 50th ST., San Diego CA 92120. [12-1]

EXPERIMENTAL AND ELECTROACOUSTIC RECORDINGS FOR SALE. Many unusual titles, such as Harry Bertoia, etc. LPs a specialty. Send for free listing to: SONIC TIGER MUSIC, PO Box 715, Cambridge, MA 02140 USA. [11-4]

New Instruction Video: You too can play the Musical Saw. Everything you need to know. $29.95. From Charlie Blacklock, 1821 St. Charles St., Alameda, CA 94501. [11-3]

The Pauline Oliveros Foundation enters its second decade with a new 3-year certificate program in Deep Listening, a new catalog, a new Deep Listening recording label, and deep listening expeditions. For a catalog or information contact the Pauline Oliveros Foundation at PO Box 1956, Kingston NY 12401-0900, email Oliverosfd@aol.com; World Wide Web site at http://www.tmn.com/oh/artswire/www/pof/pof.html. [11-3]

DIDGERIDOOS — Buy direct from Australia and save. I have been asked by several Aboriginal friends of mine to help them sell their products. Each didgeridoo is about 5 ft long and a high quality instrument with traditional aboriginal designs burnt and/or painted on them. You can now purchase them direct from Australia and save. By cutting out the exorbitant fees charged by importers, distributors and middlemen, these authentic didgeridoos are now available for Australian$199 (US$155 approx), plus freight. Payment is easy by major credit cards or money order. Trade enquiries welcome. Send enquiries and orders to: Graeme Eastman, Mainz Pty Ltd., 209 Shaftesbury Ave., Bedford, W.A. 6052, Australia; Ph: +(619) 275 6246; Fax: +(619) 275 3874 [11-4]

DISAPPOINTED, reasonbased ompcosing (esthetic in stead fo($3 upmix much can IEP BEIRATH this sebek sebek 14013box, MiNneapolis 55414-0013 40 yet? no new instrums stead in thot new neu sebek [11-4]

BROADCASTATIC WVCW 640 AM / 105.3 Continental Cable FM: Experimental music radio show. Music & Noise; Fun with Tape Recorders, Record Players, annoying sounds. Please send tapes & mail to: TOMMY / PO Box 7222 / Richmond, VA 23221. [11-1]

WAYLAND HARMAN'S CLACKAMORE — "THE WORLD'S NEWEST PERCUSSIVE MELODY INSTRUMENT." Clackamore $23.00 ppd, PVC case $6.00 ppd, instructional video $20 ppd. PO Box 6444, Boise ID 83707. The Clackamore — a tool for listening to the shape of your mouth. [11-2]

Thoreau's Aeolian Harp music as he heard it at Walden Pond. Tape cassettes of the music from this harp accompanied by songs of the wood and hermit thrushes. Harp reproductions of his own design available in Walnut. Ken Turkington 1-800-692-HARP. [11-2]

The Anti-Theory Workshop is now open! An assortment of Q.R Ghazala's circuit-bent instruments are available including all 3 Incantor models (Wonderful experimental music boxes. Rewired 'Speak & Spell' series of human voice synthesizers with looping, body contacts, electric eye, voice bending, envelope LED, fluorescent display, line output, pitch control, and more. $350), the Trigon Incantor (human voice synth, aleatory music device played with 2" steel balls. $400), the Morphium (animal and machine sample bender with multi body-contacts. $460), Photon Clarinets (two-sensor step/sweep oscillator played by hand shadows. $350), plus oneof-a-kinds, ultra-deluxe versions of all instruments, special design services, etc. Write to Ghazala at **The Anti-Theory Workshop**, c/o Sound Theater, 3325 South Woodmont Ave. Cinti., OH 45213. Website: http://www.iac.net:80/~cage/reed.html. Reed's color catalog featuring 19 instruments is available from the above address for $1 plus S.A.S.E. [11-4]

Earthshaking Percussion: Djembe, Talking Drums, Didjeridu, Dumbeks, Typan, Frame Drums, Surdo, Pandiero, Tabla, Cajons, Clave, Angklung, Balafons, Clay Pot Drums, Kanjira, Bodhran, Sitar, Harmonium, Shekere, Slit Drums, Caxixi and much more. Call (404) 624-3349 for free catalog & color photos! [10-4]

Now available! **Musical Instrument Design: Information for Instrument Making**, a new book by Bart Hopkin, editor of *Experimental Musical Instruments*, published by See Sharp Press. The price is $18.95 plus $2 s&h. (This covers air mail shipping within the U.S. or surface rate

overseas; for overseas air add 25%. Customers in California add 7.25% sales tax.). *Musical Instrument Design* presents underlying principles for the design and construction of acoustic musical instruments of all sorts, with a practical, hands-on approach. There is no other book like it; no other book gathers this information under one cover. Just under 200 pages long; large format; fully illustrated. Order from *Experimental Musical Instruments*, PO Box 784, Nicasio, CA 94946, USA, phone (415) 662-2182. [11-4]

The EMI Wall Chart is a beautiful 24" x 36" wall poster, with graphic design by Gwendolyn Jones, covered with practical reference information relating to musical instruments and instrument making. Suitable for workshop, living room or art gallery. Some of the material on the chart replicates material in the *Musical Instrument Design* book (see previous ad), but since the wall chart format has its own advantages, you might be happy to have both. The price is $12. (This covers air mail shipping within the U.S. or surface rate overseas; for overseas air add 25%. Customers in California add 7.25% sales tax.) Order through *Experimental Musical Instruments*. [11-4]

Making Simple Musical Instruments: A Melodious Collection of Strings, Winds, Drums & More — A book by Bart Hopkin, editor of *Experimental Musical Instruments*, published by Lark Books. It is a collection of plans for home-buildable musical instrument, ranging in difficulty from simple to moderate. The book is written for a general, non-specialist audience, and the approach is non-technical. The instruments aren't so very far out: most of them relate to familiar instrument types and are playable as such. Yet even experienced experimenters will find some new ideas here. It's hardbound, with 144 big and very full pages, lots of color, beautiful photos & illustrations; price $24.95 plus $2 s&h. (This covers air mail shipping within the U.S. or surface rate overseas; for overseas air add 25%. Customers in California add 7.25% sales tax.) Order from Experimental Musical Instruments, PO Box 784, Nicasio, CA 94946, USA, phone (415) 662-2182. [10-4]

Air Columns and Toneholes: Principles of Wind Instrument Design is a spiral-bound booklet containing the four articles on practical wind instrument acoustics by Bart Hopkin that appeared in EMI in 1992 and 1993. The articles have been much revised and improved, and there are several additional features included. Published by Tai Hei Shakuhachi; available for $14.00. (This covers air mail shipping within the U.S. or surface rate overseas; for overseas air add 25%. Customers in California add 7.25% sales tax). Order from EMI, Box 784, Nicasio, CA 94946. [9-4]

A REMINDER — Unclassified ads here in *EMI*'s notices column are free to subscribers for up to 40 words; 40¢ per word thereafter. For others they are 40¢ per word, 15 word minimum, with a 20% discount on orders of four or more insertions of the same ad.

DISPLAY ADS IN EMI are more affordable than you might think. $60/half page, $40/quarter page, $25/eighth page. If you have a product or service that you'd like to promote just a bit more conspicuously, call or write for details: EMI PO Box 784, Nicasio, CA 94946; phone/fax 415/662-2182.

SUBSCRIPTIONS TO EMI: $24/yr for U.S.; $27/yr for Canada & Mexico; $34/yr overseas. Order from EMI, Box 784, Nicasio, CA 94946, USA. Visa/MC accepted.

EMI BACK ISSUES: Bound volume sets Vol 1 through Vol. 10: $17 per volume. (This covers air mail shipping within the U.S. or surface rate overseas; for overseas air add 25%. Customers in California add 7.25% sales tax.) . Each volume set contains all of the issues of one volume year, photocopied and bound under one cover. The photocopies are a step down in quality from the original press runs, but they are decent as photocopies go, and they are fully readable. Visa and MasterCard accepted. Order from EMI, PO Box 784, Nicasio, CA 94946, or write for a listing of back issues and their contents. Corresponding cassette tapes are available for later volumes; see information below.

CASSETTE TAPES FROM EMI: Each cassette in the EMI cassette series contains music of instruments that appeared in the newsletter during the corresponding volume year, comprising a full measure of odd, provocative, funny and beautiful music. Volumes VI, VIII and 9 and 10 are available (others are now sold out). The price is $8 per cassette. This includes postage for air delivery in the U.S., Canada and Mexico, or surface delivery overseas. In California add 7.25% sales tax. For overseas air add $20%. Order from EMI, Box 784, Nicasio, CA 94946. Visa and Mastercard accepted.

The following is a list of selected articles relating to musical instruments which have appeared recently in other publications.

"Ampico's Recording Process: Its Theory and Its Hardware" by Thomas E. Kimble, and "Recording Ampico Dynamics" by Peter Brown, in *The Amica Bulletin* Vol. 33 #3 May/June 1996 (Automatic Musical Instrument Collector's Association, 919 Lantern Glow Trail, Dayton, OH 45431).

Two articles, with photographs and mechanical drawings, detailing the methods by which the Ampico company recorded piano rolls for their reproducing pianos in the 1920s.

"Construction of the Band Organ" by Leonard Grymonprez, in *The Amica Bulletin* Vol. 33 #4, July/Aug 1996 (address above).

Miscellaneous information on the mechanics of the self-playing, mechanical pneumatic musical instrument known as the band organ.

"The Raffles Gamelan at Claydon House" by Sam Quigley, in *Journal of the American Musical Instrument Society* Volume XXII, 1996 (6114 Corbin Ave., Tarzana, CA 91356-1011).

An extensive and detailed report on one of several gamelan obtained by the British colonialist Sir Thomas Stamford Raffles (1781-1826); this one currently housed in private home in England.

Also contained in the 1996 edition of the *Journal of the American Musical Instrument Society* are articles on an early flute, an early oboe, and an early clarinet.

"Infrasound" by John D. Cody, in *Borderlands: A Quarterly Journal of Borderland Research*, Volume LII #2, 2nd Quarter 1996 (PO Box 220, Bayside, CA 95524.)

A report on natural sources of infrasound (sound below the human hearing range), including earthquakes, ocean waves, fire and wind.

This year's edition of *The Improvisor: The International Journal of Free Improvisation* (Volume XI, 1996; 1705 12th St. South, Birmingham AL 35205) is a very substantial book, with about 30 articles plus a load of reviews. Among the articles that will interest *EMI* readers:

"Philip W. Schreck: Loose Wires & Burnt Ivory," an interview by Annie Gosfield. Schreck is an intriguing musician with a fascinating history, and a salty and engaging manner of speaking. In this interview he talks about experiments in the mis-use of pianos, and work with untrained musicians playing scrapyard percussion in producing WWII propaganda films for the U.S. Army.

"The Haters," no author credited. The Haters are a performance group, many of whose often-dangerous performances are about sound. In this short article we hear about performances involving explosives, and explorations of the sound of tearing paper.

Several articles of interest appear in *Woodwind Quarterly* Issue 13 (1513 Old CC Rd., Colville, WA 99114), including —

"Ebony" (no author credited): a one-page discussion of ebony, with descriptions of its woodworking properties.

"The Wee Piper," by Michael S. MacHarg: Several pages of Q & A on the subject of bagpipe making and repair.

"Double Reed Making for Early Winds, Part III" by Keith Lorraine: the final installment in the author's detailed, extensively illustrated discussion of double reed making.

"Determining the Step Size of a Recorder," by Alec V. Loretto: a discussion of the sizing of the windway opening in recorders.

"The Influence of Mode Spacing on the Sound of Early Flutes," by John W. Coltman: A tutorial on the effects of overtone tuning on flute tone, using one renaissance flute and one baroque flute from the author's collection as test cases.

"String Band Evaluation (Part 6)" by Joseph Jourdain, in *Folk Harp Journal* #91, Spring 1996 (4718 Maychelle Dr., Anaheim CA 92807-3040 USA).

The author continues his exposition of principles underlying string scaling for harps.

"Air Resonances in the Harp" by Jason Eyster, in *Folk Harp Journal* #92, Summer 1996 (address above).

An explanation of air resonances within harp sound chambers, complete with formulas for calculating resonances given chamber volume, sound hole size and sound hole thickness or depth.

Also in *Folk Harp Journal* #91 and 92 (address above): several articles on cross-stringing in folk harps.

"Leblanc Turns 50" in *Music Trades*, February 1996 (PO Box 432, Englewood, NJ 07631).

A retrospective on the Leblanc company, leading manufacturers of band instruments.

"The Adaptation and Change in Function of Early Musical Instruments" by Gerhard Stradner, in *AMIS Newsletter* Vol. 25 #2, June 1996 (4023 Lucerne Dr., Huntsville, AL 35802).

An overview of the ways in which early musical instruments are often retrofitted to meet changing needs in music-making, from the point of view of a museum director with an orientation to European instruments.

FoMRHI Quarterly No. 84, July 1996 (Fellowship of Makers and Researchers of Historical Instruments, 171 Iffley Rd., Oxford OX4 1EL, U.K.) contains communications on a variety of topics, including gut strings and sinew strings, musical instrument museums in Paris, and mechanical properties of soundboard woods.